RECORD OF DECISION

DECLARATION, DECISION SUMMARY, AND RESPONSIVENESS SUMMARY

FOR

REMEDIAL ACTION
AT
FMC CORPORATION
YAKIMA, WASHINGTON

SEPTEMBER 1990

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON

DECLARATION

for the FMC
Superfund Site

SITE NAME AND LOCATION

FMC Pesticide Formulation Facility
Yakima, Washington

STATEMENT OF PURPOSE

This decision document presents the remedial action selected by the U.S. Environmental Protection Agency (EPA) for the Farm Machinery Corporation (FMC) Superfund Site in Yakima, Washington. The selected action was developed in accordance with The Comprehensive Environmental Response Compensation and Liability Act (CERCLA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site. The State of Washington concurs with this selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances at and from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy addresses the contaminated soils and structures at the FMC site. At present, the only significant health risks posed by the site are associated with these contaminated materials. Concentrations of contaminants in groundwater are currently below health-based levels, and do not require treatment. Continued groundwater monitoring will be performed as part of this response action, to confirm the effectiveness of source removal in protecting groundwater. If groundwater remediation proves to be necessary, it will be conducted as part of a second operable unit of site remediation.

The selected remedy consists of:

- Sampling of soils and concrete structures to refine the current estimate of the lateral and vertical extent of material requiring treatment
- Excavation of contaminated soils
- On-site incineration of contaminated soils
- Dismantling contaminated slabs and portions of the buildings that are determined to exceed cleanup goals. Where the removal of a portion of a building affects the safety or structural integrity of that building appropriate repairs will be made.
- On-site incineration of contaminated concrete and debris or disposal at a RCRA-Subtitle C permitted hazardous waste disposal facility, depending on volume.
- Following incineration, the ash will be analyzed to determine degree of contaminant destruction and leachability. If health-based cleanup goals are met the ash will be considered to be delisted and used for backfill on site.
- Continued groundwater monitoring for 5 years to confirm source removal.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because this remedy will not leave hazardous substances remaining on-site above health-based levels, the five-year review will not be required for this action. However, groundwater monitoring will continue in order to confirm that removal of contaminated soils has been complete and that no groundwater contamination above health-based levels is present.

Thomas P. Dirmne
Name
Regional Administrator
U.S. EPA Region 10

September 14, 1990
Date

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DECISION SUMMARY

I. SITE DESCRIPTION

Name and Location

The FMC pesticide formulation facility site is located at 4 West Washington Avenue, in Yakima, Washington (see Figure 1). The site consists of a 58,000-square-foot fenced area on the northeastern portion of a 10-acre property owned by Upland Industries. The site is located in the lower Ahtanum Valley, an area of about 100 square miles in central Yakima County, Washington. Remaining structures include an office building, a warehouse, several small sheds, and the foundations of a liquid formulation building and a second warehouse. With the exception of the office building, all of these structures are within the fenced area (see Figure 2).

Topography and Vegetation

The FMC Yakima site slopes to the southeast, with a grade of less than one percent. The Yakima River lies approximately 1.5 miles from the site. The property is outside the 500-year flood plain of Wide Hollow Creek. There are no wetlands on the site. Vegetation within the fenced site area is limited to kochia, growing in the pavement cracks, and stands of kochia and thistle in the unpaved areas near the fenceline. Vegetation on the remainder of the Upland Property is dominated by dense stands of weedy forbs and grasses consisting mainly of kochia, hoary cress, prickly lettuce, wavy-leaf thistle, and brome grasses.

Adjacent Land Uses

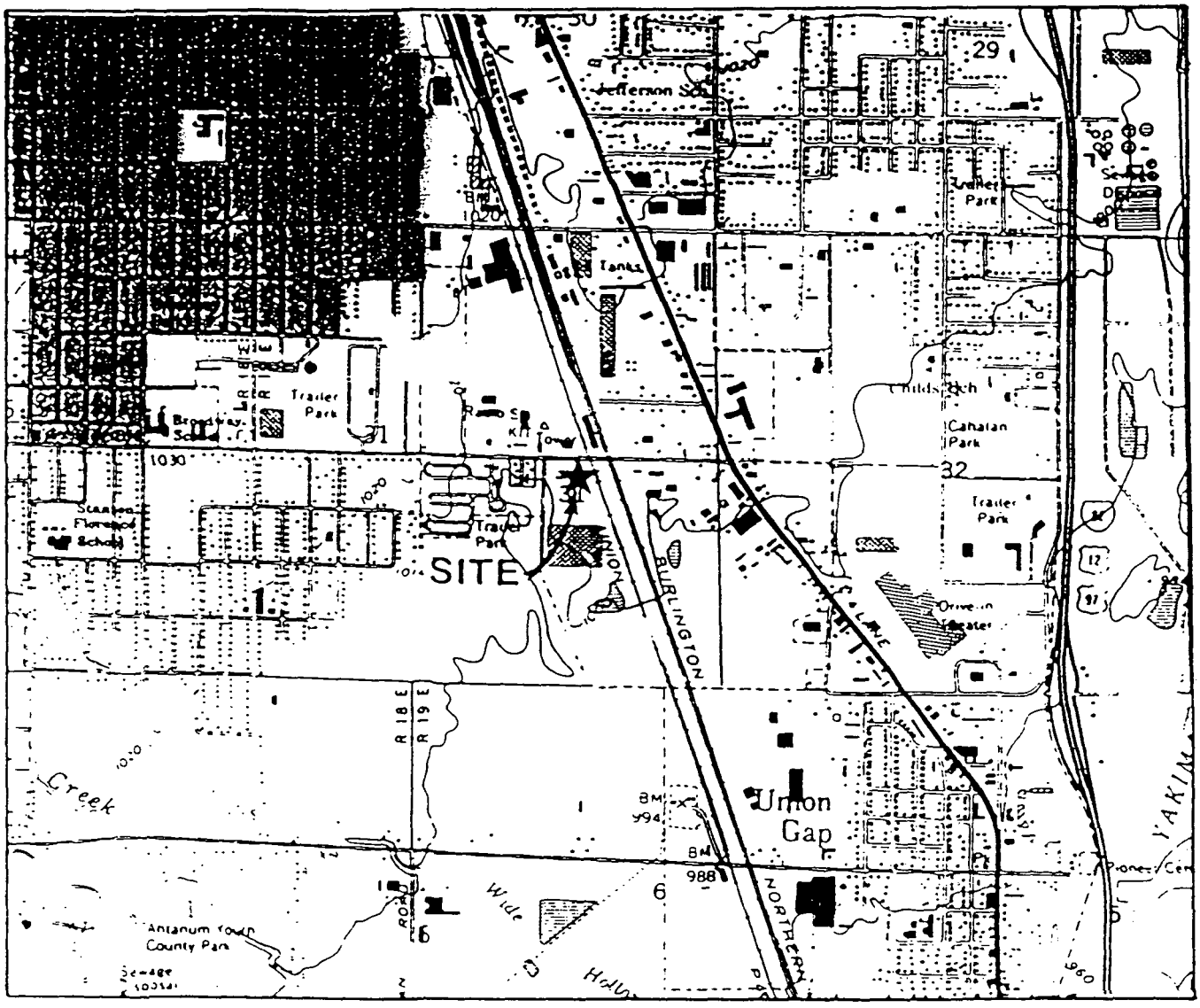
Most of the land surrounding the site is zoned for light industrial use. There is one two-acre parcel bordering the western side of the Upland property that is zoned two-family residential. Four schools are located within one mile of the site. The closest two of these are 4500 feet from the site. Five more schools are located one to two miles from the site. The population of Yakima was 49,826 in 1980. The FMC site is located in the South Broadway neighborhood area, which had a population of 6,482 persons in 1980.

Surface Water and Groundwater Resources

There are no surface water bodies or wetlands on the site. Groundwater from the unconfined Alluvium aquifer supplies much of the domestic and irrigation water in the lower Ahtanum Valley. Unconsolidated Alluvium to a depth of about 37 feet has been encountered during exploratory and monitoring well drilling at the site. The underlying cemented basalt gravel hydrological unit has not been penetrated at the site. Regional studies indicate, however, that permeable sand lenses are contained as confined aquifers within the low permeability cemented basalt gravel. The cemented basalt gravel acts as an aquitard beneath the overlying Alluvium. There is generally an upward movement of groundwater into the unconfined Alluvium aquifer from underlying confined aquifers.

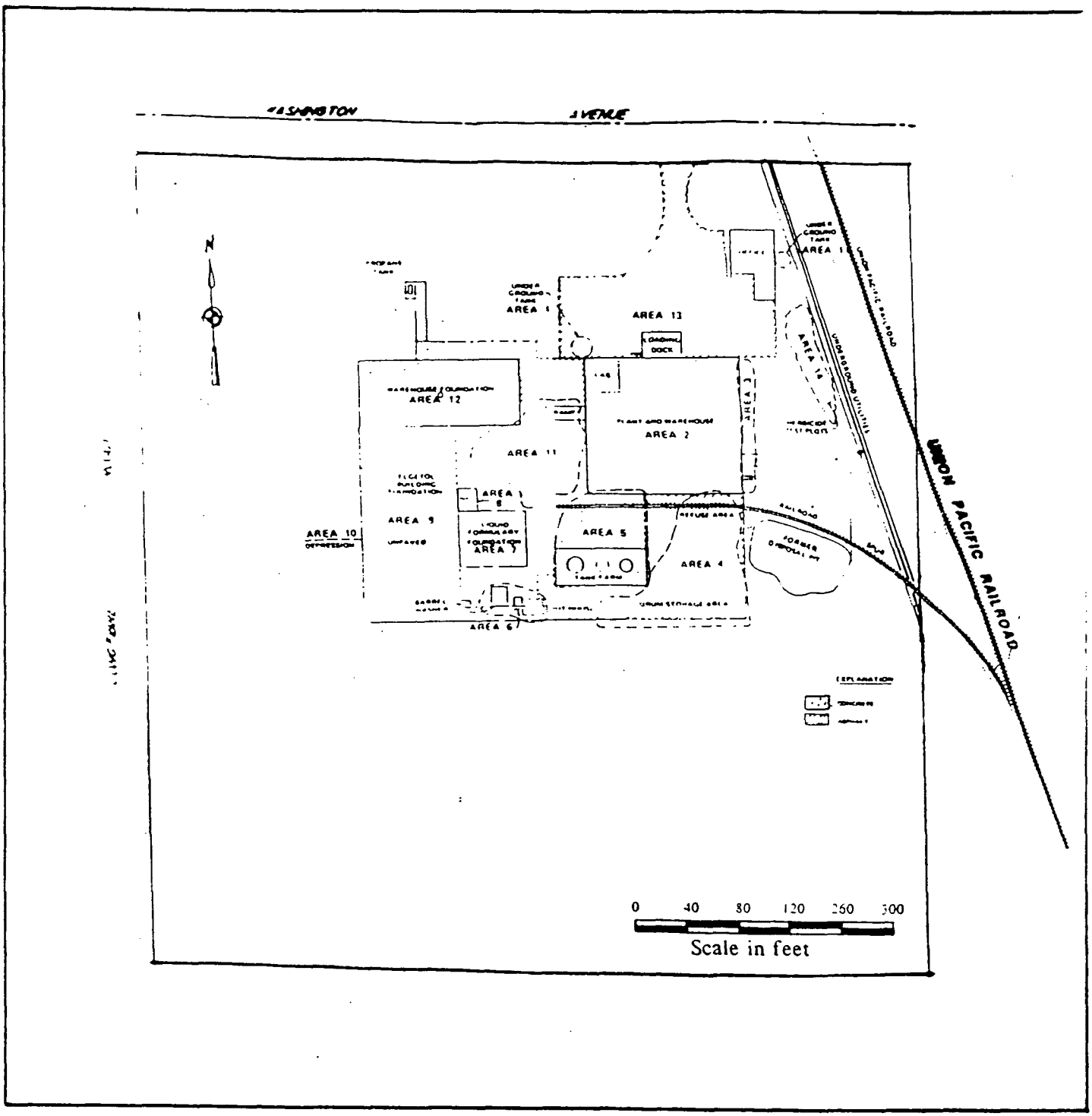
The water table is generally less than 10 feet below the ground surface. Yields of 100 to 400 gallons per minute can be obtained from wells 30 feet deep. Irrigation makes up 75% of groundwater use in the area, with the remainder supplied for industrial, domestic, and public needs. The water quality is usually considered satisfactory for most purposes, although the water from many wells contains more minerals than is desirable for domestic use.

FIGURE 1
REGIONAL MAP SHOWING THE LOCATION OF THE FMC SITE IN YAKIMA, WA.



Source: U.S. Geological Survey Yakima East 7½ Minute Quadrangle, Photorevised 1985.

FIGURE 2
MAP OF THE FMC PESTICIDE FORMULATION FACILITY, YAKIMA, WASHINGTON



II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

History of Site Activities

FMC leased the plant property from Union Pacific Land Resources Corporation (Upland), and operated the plant from 1951 to 1986 to manufacture pesticide dusts and liquids. Pesticide dusts were formulated at the facility throughout its operation. The plant began formulating liquid products in the 1970s, when the liquid formulary and the Elgetol building were added. Formulation ingredients included active ingredients, solvents, emulsifiers and stabilizers, and inert ingredients. Production took place in the dust mill, which was housed in the southeastern end of the main plant and warehouse building, the liquid formulary, and the Elgetol building. The latter two buildings were destroyed during an explosion that occurred after the plant closed, in 1986. Other operations included a drum washing area located at the southwestern end of the property, a "hot house", used to heat products to aid in formulation, located immediately to the east of the barrel washing area, and a herbicide test plot. Spills, leaks, and other accidental releases of liquid formulation materials are believed to be the source of soil and concrete contamination in and adjacent to these areas.

Between 1952 and 1969, FMC disposed of wastes containing pesticides in an on-site pit. The location of the pit was determined using historical aerial photographs, and confirmed during the Phase I Remedial Investigation (RI) conducted by Bechtel Environmental, Inc. (Bechtel), in 1987. An estimated 2000 lbs. of materials were discarded in the pit. Raw material containers, soil contaminated by leaks or spills from process equipment, broken bags, and off-specification materials were dumped into the excavated pit and covered with dirt. After 1969, waste materials were disposed of at Yakima Valley Disposal and Chem Securities in Arlington, Oregon. In 1982, the FMC site was placed on the National Priorities List (NPL), based on high levels of pesticides in the waste pit. In 1986, after operations at the facility had ceased, FMC conducted a preliminary cleanup of the facility that included removal of all contents of the main facility warehouse and surface tanks, and washing the warehouse floors and walls.

History of Federal and State Site Investigations and Removal and Remedial Actions Conducted Under CERCLA or Other Authorities

In 1982, an EPA contractor, Ecology and Environment, Inc., conducted a preliminary investigation of the site for the EPA. Findings were presented in a report dated July 8, 1982 (Preliminary Field Investigation Report, Upland Industries Site). On June 10, 1983, the State of Washington issued Administrative Order No. DE 83-283 requiring FMC to implement a testing plan, initiated by FMC and approved by the Washington Department of Ecology (Ecology), to determine whether the former disposal pit was contaminating area groundwater and the Yakima River.

On July 31, 1987, EPA issued an Administrative Order On Consent requiring and authorizing FMC to conduct the Remedial Investigation/Feasibility Study (RI/FS) for the site. In November 1987, RI Phase I sampling conducted by FMC's consultant, Bechtel Environmental, Inc., confirmed "hot spots" of DDT and other pesticide contamination in the former disposal pit at levels of up to 25,000 mg/kg. Consequently, an Order On Consent For Necessary Response Actions was issued by EPA on May 31, 1988. Pursuant to this order, FMC performed a removal and properly disposed of the pit's contaminants.

The Phase I removal of the contents of the former disposal pit was performed in June 1988. The pit was excavated to a depth of 4 feet (the depth of the groundwater table at the time), and 500 tons of contaminated soil was removed. Pit samples were analyzed for organochlorine pesticides, and soil above the groundwater table contaminated in excess of 1 mg/kg was removed. In March 1989, an additional 350 tons of soils were removed, which increased the depth of the excavation to approximately 8 feet, the depth to which the groundwater had dropped due to seasonal fluctuation. During this second removal, factors

limiting excavation included the presence of a railroad spur, as well as the groundwater table. Several "hot spots" of contamination could not be further excavated without impacting the integrity of the spur or excavating into the groundwater.

Because it was decided to promptly address the contamination in the former disposal pit, the RI/FS was conducted in phases. Phase I principally concerned the disposal pit. Phase II, completed in April 1990, incorporates the Phase I data and results, and addresses the entire site.

FMC has never contested its status as a responsible party, and has worked cooperatively with EPA to undertake the initial removal actions and subsequent RI/FS activities.

EPA proposes that a Consent Decree, under which FMC will conduct the Remedial Action for the site, be negotiated and signed by EPA, the Department of Justice, FMC, and the State of Washington, if the latter so desires. After this Record of Decision (ROD) is issued, EPA plans to issue a Special Notice Letter and begin formal negotiations.

III. COMMUNITY RELATIONS HISTORY

CERCLA requirements for public participation include releasing the Remedial Investigation and Feasibility Study Reports and the proposed plan to the public and providing a public comment period on the feasibility study and proposed plan. EPA met these requirements in June 1990 by placing both documents in the public information repositories for the site and mailing copies of the proposed plan to individuals on the mailing list. EPA published a notice of the release of the RI/FS and proposed plan in the Yakima Herald Republic on June 25, 1990. Notice of the 30-day public comment period and the public meeting discussing the proposed plan were included in the newspaper notices. The public meeting was held on July 11, 1990, at the Cascade Natural Gas Meeting Rooms. The public comment period ended on July 25, 1990, with no comments from the public.

To date, the following community relations activities have been conducted by EPA at the FMC site:

July 1987	Community Relations Plan was published, which included interviews from members of the community and local officials.
July 1987	Information repository established at the Yakima Regional Library.
August 5, 1987	EPA distributed a fact sheet announcing the startup of the Remedial Investigation.
June 3, 1988	EPA released a fact sheet announcing a removal action of contaminated soil from the disposal pit.
May 5, 1989	Fact sheet was released, announcing the second phase of the RI and the FS.
February 9, 1990	EPA distributed a fact sheet, which explained the submittal of the RI/FS draft.
June 20, 1990	EPA mailed the proposed plan fact sheet, which explained the results of the RI/FS and EPA's preferred plan, to persons on the mailing list for public comment. The fact sheet announced a public meeting for July 11, 1990, and gave the dates of the public comment period.
June 21, 1990	EPA sent a News Release announcing a news briefing for all members of the Yakima news media.

June 25, 1990	A public notice in the Yakima Herald Republic described the availability of the proposed plan and the RI/FS, and announced the dates of the public meeting and public comment period.
June 25 - July 25, 1990	Public comment period for proposed plan and RI/FS.
June 28, 1990	EPA conducted a news briefing for members of the press announcing the proposed plan.
July 5-11, 1990	The local community calendar on television announced the date of the public meeting.
July 11, 1990	EPA conducted a public meeting for interested community members.
August 1990	Responsiveness Summary prepared.

IV. SCOPE AND ROLE OF THE RESPONSE ACTION WITHIN THE SITE STRATEGY

The Phase I RI (Bechtel, 1988) indicated that soils in the former disposal pit had very high concentrations of pesticides (up to 25,000 mg/kg of DDT). EPA therefore determined that the contaminated materials should be quickly removed from the pit area as a major step toward remediation of the site. Two pit excavations followed, and a significant amount of the contamination was removed. The selected response action of this ROD addresses the contamination that remains in the formulation areas and some contaminated soils in the former disposal pit.

The principal threat at the FMC site is the potential for exposure to pesticides and metals resulting from contact with contaminated soils. The site is located close to a large population center, with several schools within one mile. This response action is designed to remove the principal threat to public health by significantly reducing the volume of the contaminated soil.

In addition, this response action will reduce the potential for the contaminated soil to act as a source for groundwater contamination. The current low levels of site related groundwater contamination do not pose a significant public health threat, and when the source removal has been completed, these levels are expected to decrease gradually over time. Currently there are no on-site residents and on-site groundwater is not used for drinking water. Residents in the vicinity of the site get drinking water from a protected public water supply. Therefore, no current ingestion of groundwater containing site contaminants is known to occur. Groundwater sampling began during November 1987 and has been conducted quarterly since. Groundwater monitoring will be continued to confirm that contaminant levels are decreasing. Additional wells have recently been installed to further define the extent of groundwater contamination, and to confirm that contamination does not exceed health-based levels. If the quality of the groundwater exceeds these levels during monitoring, appropriate measures would be taken under a separate response action.

Portions of buildings and other concrete structures have also been found to contain high levels of pesticide contamination. Contaminated portions of structures will be dismantled and incinerated or removed from the site during this response action. Arrangements will be made for their disposal at a RCRA Subtitle C permitted hazardous waste landfill if incineration is not practicable. The health risks associated with contaminated concrete are difficult to quantify. However, removal of contaminated concrete will lessen the need to restrict future site use.

V. SUMMARY OF SITE CHARACTERISTICS

Contaminant Characteristics

Operations connected with the production of pesticides by the FMC Corporation are the only known sources of contamination at the site. Table 1 provides a summary of groundwater sampling data showing the pattern in contaminant concentrations and detection frequency before and after excavation of the disposal pit. Table 2 summarizes the contaminants detected in soils and concrete at the FMC site. The contaminants of concern for human health at the site are DDD (1,1-dichloro-2,2-bis(p-chlorophenyl) ethane), DDE (1,1-dichloro-2,2-bis(p-chlorophenyl) ethylene), DDT (1,1,1-trichloro-2,2-bis(p-chlorophenyl) ethane), dieldrin, endosulfans, malathion, ethion, ethyl parathion, parathion, DNOC (4,6-dinitro-o-cresol), cadmium, and chromium VI. All of these compounds are considered toxic. Cadmium, chromium VI, DDD, DDE, DDT, and dieldrin are also carcinogenic by some exposure routes. The contaminants of concern for potential environmental effects are DDD, DDE, DDT, endosulfans, ethion, malathion, and zinc. Pesticides found on-site are discarded commercial chemical products, off-specification commercial chemical products and spill residues thereof. Many of the compounds handled by the facility, and still found there, are listed in CFR 40 part 261.33 (e) and (f) are thus are RCRA listed hazardous wastes.

During the remedial investigation, samples were analyzed for total chromium. No differentiation was made between the valence forms (chromium III and chromium VI). Because chromium VI is far more toxic than chromium III, sampling and analysis to define the distribution of the two valence forms will be conducted during the first stages of the remedial action. If large volumes of soil are found to be contaminated with chromium VI at levels requiring remediation, modifications in the remedial process may be necessary.

An estimated 900 cubic yards of contaminated soils will be remediated under this response action. This includes approximately 400 cubic yards of surface soils (soils less than 2 feet below ground surface), 400 to 480 cubic yards of subsurface soils, and 100 cubic yards of contaminated soils remaining in the former disposal pit.

Affected Matrices, Characteristics, and Migration Pathways

Contaminants are present in the concrete floors and walls of formulation buildings and warehouses, in some concrete slabs, and in surface and subsurface soils in portions of the site associated with pesticide production. There is some contamination remaining in the disposal pit, and contaminants are also present at low levels in the groundwater beneath the site.

Soils

The site soils consist of a 5 to 8 foot thick layer of Naches loam which is a highly permeable, well-drained soil. Beneath the soil is an unconsolidated alluvium layer consisting of predominantly sand and gravel, estimated to be 37 feet thick.

The majority of the contamination remaining at the site is located in the surface and subsurface soils. An estimated 900 cubic yards of surface soils and subsurface soils must be remediated. This includes the stained soils directly below a stained area on the eastern exterior wall of the warehouse; soils along the south fence of the refuse and drum storage area; soils underlying a concrete pad on which formulation liquids were stored; soils from the gravel-covered areas surrounding the concrete pad at the Barrel Wash Area; soils surrounding the concrete pads in both the Liquid Formulary Area and the Elgetol Area; soils in the unpaved area west of the Elgetol Area; and the remaining contaminated soil in the former disposal pit.

There are two routes of contaminant migration from soils at the site: through the groundwater and the air. Infiltration of precipitation, and fluctuating groundwater levels, may

TABLE 1

SUMMARY OF CONTAMINANTS FOUND IN THE GROUNDWATER OF THE FMC-YAKIMA SITE

	Historical Data Nov. 87 - Dec. 89		Current Data June 89 - July 90	
	Concentration Range (µg/L)	Frequency of Detection	Concentration Range (µg/l)	Frequency of Detection
ORGANOCHLORINE				
Aldrin	0.01	1/61		0/60
a-BHC	0.01-0.09	7/61	0.01-0.06	3/57
b-BHC	0.02-0.07	3/61	0.02-0.07	2/55
d-BHC	0.01-0.23	8/58	0.01-0.23	7/57
g-BHC	0.01-0.07	7/61		0/43
Chlordane				0/57
4,4'-DDD	0-0.12	15/60	0.02-0.15	5/57
4,4'-DDE	0.01-0.16	14/81	0.01-0.06	9/58
4,4'-DDT	0.02-9.9	29/61	0.02-0.11	14/55
Dicofol	0.13-0.14	2/61		0/41
Dieldrin	0.01-0.09	8/61	0.01-0.09	7/58
Endosulfan I	0.01-1.1	38/61	0.01-0.6	36/59
Endosulfan II	0.01-0.55	39/61	0.01-0.6	28/51
Endosulfan Sulfate	0.02-0.56	34/61	0.05-0.56J	24/54
Endrin	0.02	1/61	0.01	1/46
Heptachlor	0.01	1/61		0/53
Heptachlor Epoxide	0.05	1/61		0/53
Ovex	0.02-0.48	11/61	0.02-0.06	6/49
Toxaphene	0.4	2/61		0/53
ORGANOPHOSPHATE				
Ethion	1.1	1/61		0/52
Ethyl Parathion				0/52
Methyl Parathion				0/52
Malathion	0.5-1	2/61		0/52
Diazinon				0/50
CARBAMATE AND UREA				
Carbaryl				0/52
Diuron				0/52
TOTAL PHENOLS	0.005-60	12/46		0/10
PHENOLS				
2,4-Dimethyl Phenol				0/24
2 Chlorophenol	1	2/46	1.0	2/29

TABLE 1 (Cont.)

SUMMARY OF CONTAMINANTS FOUND IN THE GROUNDWATER OF THE FMC-YAKIMA SITE

	Historical Data Nov. 87 - Dec. 89		Current Data June 89 - July 90	
	Concentration Range (µg/L)	Frequency of Detection	Concentration Range (µg/l)	Frequency of Detection
VOLATILE ORGANICS				
Methylene Chloride	1BJ-820B	13/53	1J	1/41
Acetone	1BJ-16000	35/53	1BJ-23	19/41
Carbon Disulfide	2.0-25.0	6/53	2J-72	9/41
1,1-Dichloroethane	5	1/53		0/37
Chloroform	1.0-2.0	6/53	1J-2J	7/41
2-Butanone	1BJ-4BJ	6/53	2BJ	1/47
Trichloroethene	1.0-47.0	3/53	1J-47	3/47
4-Methyl-2-Pentanone	2J	1/53		0/37
2-Hexanone	1BJ-2J	3/53		0/37
Tetrachoroethene	2J-5.0	33/53	1J-9	38/41
Toluene	1J-10.0	9/53	1J-6	4/40
2-Propanol	10J-1000J	5/53	NA	NA
Ethylbenzene				0/37
Total Xylenes				0/37
METALS				
Arsenic				0/48
Barium	10B-165B	17/28	10B-410	15/44
Cadmium			5-20	6/50
Calcium	27.0-34600	20/20	30,600-34,600	11/11
Total Chromium	13.0-20.0	2/61	26-34	2/50
Chromium (VI)	11	2/28		0/49
Copper	0.07-75	14/61	18-90	16/39
Lead	3.9-24.8	11/28	3.1-24.8	21/50
Magnesium	8.2-10800	20/20	8620-9930	11/11
Potassium	2.6-4530	20/20	3430B-4530B	11/11
Selenium	5	1/28	5	7/47
Sodium	8.8-14200	20/20	12,800-14,200	11/11
Zinc	13-6500	23/28	13B-6500	37/43

Notes

B Compound found in blank
J Estimated value
NA Not Analyzed

Blanks in Table indicate not detected

TABLE 2
SUMMARY OF CONTAMINANTS FOUND IN THE SOILS AND STRUCTURES OF THE FMC-YAKIMA SITE

	Surface Soil From Formulation Area		Subsurface Soil From Formulation Areas		Subsurface Soil From Pit		Concrete from Formulation Areas	
	Concentration Range (mg/kg)	Frequency of Detection	Concentration Range (mg/kg)	Frequency of Detection	Concentration Range (mg/kg)	Frequency of Detection	Concentration Range (mg/kg)	Frequency of Detection
ORGANOCHLORINE								
Aldrin	0.27-0.14	2/28			0.10-0.6(a)	3/55	0.1-73	3/23
a-BHC	0.1	1/28			0.2(a)	1/55		
b-BHC								
d-BHC					0.01-0.2	5/14		
g-BHC	0.42	1/28			0.4-3.3	2/55		
Chlordane								
DDD	0.13-0.27	2/28	76	1/16	0.02	31/55	0.05-0.4	3/23
DDE	0.01-1.4	20/28	1.5-28	4/16	0.02-0.71	15/55	0.01-22	19/23
DDT	0.02-11	22/28	0.039-210	5/16	0.05-39	45/55	0.02-11	10/23
Dicofol	0.04-14000	6/28			0.1-0.3(a)	7/41	0.1-110000	12/23
Dieldrin	0.14-0.49	3/28	0.19-40	2/16	0.01-4	9/14	0.01-1.1	13/23
Endosulfan I	0.13-7000	13/28	0.07-860	12/16	0.1-5.2	11/55	0.01-26	4/23
Endosulfan II	0.01-4500	14/28	0.088-450	14/16	0.01-0.7	11/55	0.01-22	5/23
Endosulfan Sulfate	0.17	1/28	100	1/15				
Endrin							1	1/23
Heptachlor								
Heptachlor Epoxide								
Ovex	0.02-5.6	6/28			0.05-42	43/55		
Toxaphene			0.67-1.7	3/15				
ORGANOPHOSPHATES								
Ethion	0.05-3100	13/28	0.16-180	16/16	0.05-74	13/14	0.05-9300	10/23
Ethyl Parathion	4.5-3300	3/28	0.11-30	8/16	0.27-15	4/14	0.05-13000	8/23
Methyl Parathion							110	1/23
Malathion	0.05-170000	10/28	0.08-9.5	9/16			0.05-160000	14/23
Ethylene							73	1/23
Diazinon			0.14-4.5	3/15				
CARBAMATES AND UREA								
Carbaryl	0.97-760	3/26			4.2-13	2/14	0.05-1700	8/12
Diuron					0.2	1/14		
TOTAL PHENOLS	0.57-7.6	5/28	1.0-6.5	11/15	2.0-4.0	3/14	0.5-49	7/12
PHENOLS								
2,4-Dimethyl Phenol							130000	1/4
2 methyl-4,6 dinitrophenol	5000	1/28						
2 Chlorophenol								

TABLE 2 (Cont)
SUMMARY OF CONTAMINANTS FOUND IN THE SOILS AND STRUCTURES OF THE FMC-YAKIMA SITE

	Surface Soil From Formulation Area		Subsurface Soil From Formulation Areas		Subsurface Soil From Pit		Concrete from Formulation Areas	
	Concentration Range (mg/kg)	Frequency of Detection	Concentration Range (mg/kg)	Frequency of Detection	Concentration Range (mg/kg)	Frequency of Detection	Concentration Range (mg/kg)	Frequency of Detection
VOLATILE ORGANICS	NA	NA			NA	NA	NA	NA
Methylene Chloride	NA	NA			NA	NA	NA	NA
Acetone	NA	NA	0.004J-0.17B	10/11	NA	NA	NA	NA
Carbon Disulfide	NA	NA			NA	NA	NA	NA
1,1-Dichloroethane	NA	NA			NA	NA	NA	NA
Chloroform	NA	NA			NA	NA	NA	NA
2-Butanone	NA	NA	0.002J-0.009J	5/11	NA	NA	NA	NA
Trichloroethene	NA	NA	0.001J-0.002J	6/11	NA	NA	NA	NA
4-Methyl-2-Pentanone	NA	NA			NA	NA	NA	NA
2-Hexanone	NA	NA	0.001J-0.003J	2/11	NA	NA	NA	NA
Tetrachoroethene	NA	NA	0.001J	1/11	NA	NA	NA	NA
Toluene	NA	NA	0.002J-0.21	10/11	NA	NA	NA	NA
2-Propanol	NA	NA			NA	NA	NA	NA
Ethylbenzene			0.002J-0.018J	2/11				
Total Xylenes			0.013-1.1	4/11				
SEMI-VOLATILE ORGANICS								
2-Methylnapthalene	NA	NA	0.058J	1/11	NA	NA	NA	NA
METALS								
Arsenic	NA	NA	1.5B-3.2	14/16	NA	NA	NA	NA
Barium	NA	NA	54.5-170	16/16	NA	NA	NA	NA
Cadmium	NA	NA	2.5-6	16/16	NA	NA	NA	NA
Calcium			NA	NA				
Total Chromium	2.7-320	1/28	12.5-30.1	16/16	2.0-20	12/14	15-1620	23/23
Chromium (VI)	NA	NA	NA	NA	NA	NA	NA	NA
Copper	12-126	1/28	15-88.3	16/16	6.9-90	14/14	14-312	23/23
Lead	NA	NA	3.2-32.9	16/16	NA	NA	NA	NA
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA			NA	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	59.4-1020	16/16	NA	NA	NA	NA

Notes

Blanks in table indicate not detected
NA Not Analyzed
J Estimated value
(a) Includes surface soil sample taken from Area 3
(b) Chemical detected in field analysis of pit samples only

carry contaminants into the groundwater. Wind dispersion of contaminated soil particles is considered to be the primary route of migration through the air. Since the pesticides and metals detected at the site have relatively low vapor pressures, volatilization is not expected to be a significant pathway.

Concrete Structures

Portions of the formulation buildings and warehouses, as well as some concrete slabs, are contaminated. Limited information is available on the actual distribution of contamination on the surfaces of the concrete structures, since only limited sampling and analysis was conducted. Areas of contamination include: the southeast corner of the plant and warehouse building; the concrete tank farm pad in area 5; a concrete slab and barrel washing sump in Area 6; a slab in Area 7; and the foundation of the Elgetol Area (see Figure 2). An estimated total of 1460 square feet of contaminated surfaces are expected to require remediation in these areas.

Since the contamination present in these structures is bound to the concrete, and the contaminants of concern are non-volatile, the contaminants are not mobile if the structures remain undisturbed. The potential risk associated with these structures in their present state is through dermal contact with the contaminated surfaces. In the site's present state, these risks are considered to be very low. However, if these structures are gritblasted or demolished, controls will be required to prevent contaminated dust from becoming airborne.

Groundwater

Groundwater contamination has been found at very low concentrations. Organochlorine pesticides are the most frequently detected contaminants in groundwater. With the exception of malathion, detected once (1.0 μg/l) in June 1988, organophosphorus pesticides have not been detected in groundwater since the first sampling round in November 1987. Several volatile organics have been detected in ground water in both the on-site and off-site wells. It is believed that the presence of methylene chloride, acetone, 2-butanone and 2-hexanone are primarily due to laboratory contamination because they were also found in laboratory blanks. Tetrachloroethene has been detected in a high percentage of the samples at a range of 2.0 to 9.0 μg/L. Because tetrachloroethene has been found in all the wells, including the off-site upgradient well, it is believed that the presence of this chemical is not related to the FMC site. Regional studies are currently underway to evaluate potential sources of this contamination. There is no current groundwater use on site, nearby businesses and homes have access to a public water supply system.

Most of the original monitoring wells are located in the vicinity of the former disposal pit. Additional wells have recently been installed to further define the extent of contamination and estimate hydraulic characteristics of the aquifer. The hydraulic gradient in the surficial aquifer at the site has been estimated at 0.002 to 0.003; the results of the aquifer pump test conducted on-site were used to estimate a hydraulic conductivity in the saturated thickness of 5,000 gpd/sq.ft. Continued monitoring and evaluation of data will be conducted.

Surface Water

There are no surface water bodies on the FMC site. The site is segregated from storm runoff by bermed railroad tracks to the east, and by road curbs to the north. The unpaved portions of the site are covered with highly permeable soil, and the site has a slope of less than one percent. Because of these conditions, the potential for migration of contaminants by precipitation runoff is minimal.

Regulatory Requirements for Addressing Site Risks

EPA's National Oil and Hazardous Substance Contingency Plan (NCP), found in 40 CFR Part 300, requires that the site's remediation goals are protective of human health and the environment. Initially, contaminant concentrations are compared to existing criteria such as Safe Drinking Water Act maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs), and Clean Water Act water quality criteria (WQC). However, there are no corresponding criteria for soils and structures. Remediation goals for soils and structures is usually established by setting contaminant concentrations for cancer-causing chemicals at levels that represent cancer risks between one-in-ten-thousand (10^{-4}) and one-in-one-million (10^{-6}). For toxic compounds not identified as carcinogens, the contaminant concentration shall be protective of sensitive human subpopulations over a lifetime. Noncarcinogenic effects are expressed in terms of a "hazard index," and the remediation goals are set to result in a hazard index of less than 1.0.

VI. SUMMARY OF SITE RISKS

The risks to human health and the environment at the FMC Yakima Superfund Site are described in the site-specific risk assessment, which was prepared by Bechtel Environmental, Inc. for the FMC Corporation using current EPA guidance. Overall, the risk assessment indicates that pesticides in the soil of the FMC Yakima site pose the most significant threat to human health and the environment.

This chapter first describes the human health and environmental risk assessments done by Bechtel. The last part of this chapter describes additional studies done by EPA to address some of the uncertainties identified in the risk assessment, and to calculate health-based soil clean-up goals.

Contaminant Identification, Human Health

During the Remedial Investigation the groundwater, soils, and structures of the FMC Yakima site were analyzed for many potential contaminants, including volatile organics, metals, organochlorine pesticides, organophosphorus pesticides, carbamates, urea, and phenols. Results of these analyses were used to select contaminants of concern that were used to quantify potential risks to human health and the environment. Human health contaminants of concern include the DDT series (DDD, DDE, and DDT), total endosulfans (endosulfan I, endosulfan II, and endosulfan sulfate), ethion, malathion, 4,6-dinitro-o-cresol (DNOC), also known as elgetol, cadmium, and chromium III and VI.

The risk assessment identifies contaminants of concern in groundwater, soils, and structures. Average and maximum groundwater and soil concentrations were used.

Modeling was used to estimate concentrations of contaminated respirable particulate matter less than 10 microns in diameter (PM-10), and to estimate deposition of contaminated dusts from the site.

Exposure Assessment, Human Health

The objective of the exposure assessment is to estimate the type and magnitude of exposures from the site. This includes identifying exposure routes (ingestion, inhalation, and direct contact), land use scenarios, potentially exposed populations, estimating exposure point concentrations, and describing assumptions about exposure frequency and duration. The risk assessment calculates exposure point concentrations based on average and maximum contaminant concentrations.

General Exposure Pathways

The general exposure pathways considered for the FMC Yakima site include ingestion of contaminated groundwater, off-site transport of contaminated groundwater, incidental ingestion of contaminated soil, inhalation of contaminated PM-10 dust, off-site transport of contaminated dusts, off-site transport of contaminated sediments, direct contact with contaminated structures and soils, and food chain transfer. Currently no on-site wells are used for drinking water.

Land Use Scenarios

The risk assessment describes the following three land use scenarios for the FMC Yakima Site:

- a current scenario
- a future residential scenario (future exposure scenario I)
- a future industrial scenario (future exposure scenario II)

The current scenario assumes that access to the site is restricted, and that the site is not used for industrial or residential purposes. Most of the land surrounding the site is zoned for light industrial use. There is one two-acre parcel bordering the western side of the Upland property that is zoned two-family residential. This scenario estimates potential exposures to off-site populations and a hypothetical on-site trespasser.

The future residential scenario assumes that the site is converted to residential use, that groundwater beneath the site and down-gradient of the site is used for drinking water, and that all existing structures, such as concrete foundations, are removed. Removal of on-site structures would expose on-site and off-site populations to contaminated soils currently located beneath these structures.

The future industrial scenario assumes that the site is used for industrial purposes, that contaminated structures are left on-site, and that groundwater beneath the site and down-gradient of the site is used for drinking water. Both future scenarios result in exposures to on-site and off-site populations.

Potentially Exposed Populations and Specific Exposure Pathways

Currently there are no on-site potentially exposed populations (receptors) at the FMC Yakima site. However, there is a residential area along the western boundary of the property. Sensitive subpopulations, including schools, hospitals, and a nursing care center, are located approximately one to two miles from the site.

The current scenario evaluates off-site residents and off-site workers as potentially exposed populations, and assumes no exposure to contaminated groundwater. The potentially exposed populations for the future residential scenario include a hypothetical resident living on-site, a hypothetical resident living off-site and down-gradient of the site, and a hypothetical off-site worker. The potentially exposed populations for the future industrial scenario include an on-site industrial worker, an off-site industrial worker, and an off-site resident.

A summary of land use scenarios and specific exposure pathways is shown in Table 3.

Estimation of Exposure Point Concentrations

Exposure point concentrations were estimated by using monitoring and modeling results to calculate intakes in mg/kg-day. Intakes are directly related to the contaminant concentration, the contact rate, and exposure duration and frequency. Intakes are inversely related to body weights

TABLE 3
LAND USE SCENARIOS AND EXPOSURE PATHWAYS

Type of Exposure	CURRENT EXPOSURE SCENARIO Site not in Use	FUTURE EXPOSURE SCENARIO I Residential	FUTURE EXPOSURE SCENARIO II Industrial
Inhalation of PM-10	off-site residential off-site industrial	on-site residential off-site residential off-site industrial	on-site industrial off-site residential off-site industrial
Soil Deposition Ingestion	off-site residential off-site industrial	off-site residential off-site industrial	off-site residential off-site industrial
Soil Direct Contact (ingestion & dermal)	off-site residential off-site industrial	on-site residential off-site residential off-site industrial	on-site industrial off-site residential off-site industrial
Ground-Water Ingestion	–	on-site residential off-site residential	on-site residential off-site industrial
Concrete Dermal Contact	–	–	on-site industrial

and averaging times (the period over which the exposure is averaged). The exposure point concentrations used to calculate risks are summarized in Tables 6-5 through 6-10 in the baseline risk assessment.

Groundwater concentrations are based on a combination of monitoring and modeling results. Soil concentrations are based on monitoring results. PM-10 concentrations and quantities of deposited fugitive dusts are based on modeling results.

Intake of contaminated PM-10 (expressed as micrograms per cubic meter or $\mu g/m^3$) is based on surface soil concentrations and results of an air transport model. Maximum PM-10 concentrations occur at the eastern site boundary.

Off-site deposition of contaminated fugitive emissions was also modeled. Results were calculated in grams of contaminated dust deposited per gram of off-site soil (g_{dep}/g_{soil}) over a period of 10 to 75 years.

Average and maximum exposure point concentrations for direct contact (incidental ingestion and dermal exposure) with contaminated soils and concrete were based on analytical results of soil and concrete samples. For the current scenario, only surface soil concentrations outside of and at the fence line were used to calculate exposure point concentrations for direct contact. For the future residential scenario, soil concentrations included all on-site sampling results including soils currently under structures. For the future industrial scenario, currently exposed surface soil, and concrete concentrations, were used to calculate exposure point concentrations.

For the future residential scenario and the future industrial scenario, both an on-site and an off-site downgradient drinking water well are assumed. The exposure concentrations are based on recent groundwater sampling rounds. Exposure point concentrations for a downgradient well were estimated using a groundwater model for a well 4000 feet directly downgradient from the site. The model included a range of retardation factors from 1 to 1,000. Retardation factors are calculated to estimate the migration rate of a chemical in a soil-groundwater system. The modeling effort included maximum and average groundwater sampling results, including groundwater concentrations prior to excavation of the former disposal pit. For contaminants of concern that were not detected in groundwater, the detection limit was used as the maximum concentration, and one-half the detection limit was used as the average concentration.

Exposure Frequency and Duration Assumptions

Exposure parameters used in the exposure assessment were the standard parameters used by EPA. Additional information on exposure parameters for the current scenario is listed below:

- For calculations of chemical intakes, the exposure frequency of the trespasser in the current scenario is assumed to be 20 percent of that provided in EPA guidance. Trespasser exposure is expected to be intermittent compared to full-time worker exposure.

- The chemical intakes for off-site ingestion of deposited contaminated fugitive emissions assumes that the receptors are at the point of maximum deposition. The point of maximum deposition is at the site's eastern boundary, at or near the railroad tracks. The exposure frequency at this location is assumed to be 20 percent of that provided in EPA guidance, since no one resides or works at the point of maximum exposure.

Additional information on exposure parameters for the future residential and industrial scenarios is listed below:

- The exposure frequency to off-site receptors who come onto the site for soil direct contact is assumed to be 20 percent of the exposure to on-site receptors. This is justified by the relatively infrequent exposure of off-site receptors to on-site soils.

- The chemical intakes for off-site ingestion of deposited contaminated fugitive emissions assumes that the receptors are at the point of maximum deposition. The exposure frequency at this location is assumed to be 20 percent of that provided in EPA guidance, since no one resides or works at the point of maximum exposure.

- Intakes for dermal contact with contaminated concrete were estimated by treating the concrete as soil. Exposure parameters for this route of exposure are shown in Table 4.

Toxicity Assessment, Human Health

The first step of the toxicity assessment, hazard identification, weighs the available evidence regarding the potential for contaminants of concern to cause adverse effects in exposed individuals. The second step of the toxicity assessment, dose-response evaluation, quantitatively evaluates the toxicity information and characterizes the relationship between the dose (in mg/kg-day) and the incidence of adverse health effects in the exposed population. This is done for carcinogenic and noncarcinogenic effects. Estimates of the probability of carcinogenic effects are based on slope factors. Estimates of noncarcinogenic effects are not based on probabilities, but are based on "reference doses." These terms are described below.

Slope factors, expressed in $(mg/kg/day)^{-1}$, are toxicity values that quantitatively define the relationship between dose of a carcinogen and a lifetime upper-bound estimate of the cancer risk. These values are based on the use of animal studies and epidemiologic studies. Data from the relevant studies are fit into an appropriate model, and the upper 95th percent confidence limit of the slope of the resulting dose-response curve is calculated. This value is the slope factor. Slope factors used in this risk assessment are from EPA's Integrated Risk Information System (IRIS).

Reference doses (RfDs) have been developed for indicating the potential for adverse health effects from exposure to non-cancer causing chemicals. RfDs, expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals, that are not expected to cause an appreciable risk of harmful effects during a lifetime. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfDs. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur. RfDs used in this risk assessment are from IRIS.

Human Health Effects of Contaminants of Concern

Cadmium

Inhalation of cadmium has been shown to cause cancers of the prostate, lung, and kidney in humans. Exposure to cadmium by other routes of exposure has not been shown to be carcinogenic to humans. Chronic oral exposure to cadmium has been documented to cause noncarcinogenic effects in humans, including damage to the kidneys.

TABLE 4

EXPOSURE PARAMETERS FOR DERMAL CONTACT WITH CONTAMINATED CONCRETE

	Average Case	Upper Bound
Surface Area of Hands, m^2	0.099	0.117
Adherence, g/cm^2	1.45×10^{-5}	2.27×10^{-5}
Frequency	1 hour per week	4 hours per week

Chromium

Chromium exists in two biologically valence states: chromium III and chromium VI. Inhalation of chromium VI has been shown to cause lung cancer in humans. Chromium III has not been shown to have carcinogenic properties.

Acute effects of chromium VI include damage to the kidneys, immune system, nervous system, and liver. Effects of inhalation of chromium VI include nasal damage and respiratory dysfunction. Dermal exposure to chromium III and chromium VI can result in chromium sensitization.

DNOC (Elgetol)

4,6-dinitro-o-cresol (DNOC) has not been shown to have carcinogenic properties.

Animal studies have shown adverse health effects due to exposure to DNOC including kidney damage, central nervous system effects, cardiovascular system effects, profuse sweating, thirst, headache, loss of weight, and increased metabolic rates. High doses can be lethal.

Organochlorine Insecticides

The organochlorine insecticides include the DDT series (DDT, DDE, and DDD) and total endosulfans (endosulfan I, endosulfan II, and endosulfan sulfate).

All three chemicals of the DDT series have caused liver tumors, lung tumors, and lymphomas in mice. Chronic noncarcinogenic effects associated with the DDT series in experimental animals include liver dysfunction including microsomal enzyme induction, central nervous system (CNS) disorders including behavioral effects, hypertrophy of liver parenchymal cells and increased fat deposition, and neonatal mortality.

Acute effects of the DDT series in humans include CNS effects such as dizziness and disturbed equilibrium. Fatal human poisonings from DDT have not been documented. Chronic effects are most likely to be observed in the liver. DDT is poorly absorbed via dermal exposure.

The endosulfans are cyclodiene insecticides. Endosulfans have not been shown to have carcinogenic properties. In general, the cyclodienes are more toxic to humans than DDT, and exposure to humans can result in convulsions before other symptoms appear. Endosulfans are highly to moderately toxic via inhalation, ingestion, and dermal routes of absorption, depending on the animal species being tested. In humans, exposure to endosulfans can cause central nervous system stimulation which can be lethal. Other effects can include slight nausea, confusion, excitement, and dry mouth. Chronic exposures can cause liver effects. Endosulfans are absorbed dermally.

Organophosphorus Insecticides

The organophosphorus insecticides include ethion and malathion. Ethion and malathion have not been shown to have carcinogenic properties. Noncarcinogenic effects include inhibition of acetylcholinesterase and accumulation of acetylcholine in nervous tissues and effector organs. Symptoms resulting from these effects include anxiety, difficulty in breathing, sweating, nausea, vomiting, diarrhea, bradycardia, and constriction of the pupils (miosis). Death can result from respiratory failure. Chronic effects are generally not associated with these compounds. However, small doses over a long period of time can cause cumulative effects of acetylcholinesterase inhibition. Long-term exposure can also cause other CNS effects.

Summary of Slope Factors and Reference Doses

A summary of SFs and RfDs used in the risk assessment is given in Table 5.

Risk Characterization, Human Health

The risk characterization summarizes and integrates the toxicity and exposure assessments into quantitative and qualitative expressions of carcinogenic and noncarcinogenic risks. Carcinogenic risks are expressed as the probability of an individual contracting cancer over a lifetime as a result of exposure to a carcinogen. The 10^{-6} risk level is usually used as the point of departure for setting remediation goals if ARARs do not exist or are not sufficiently protective. Noncarcinogenic risks are expressed as a hazard index (HI), where HI = E/RfD, and E = the intake or exposure level, in mg/kg-d. If the HI is greater than 1.0, there is cause for concern of noncarcinogenic health effects.

The risk characterization of the FMC Yakima site included an assessment of average and maximum carcinogenic and noncarcinogenic risks. These risks were calculated for the current and future exposure scenarios.

Risks contributed by each pathway are summarized in tables in the baseline risk assessment. An example of risks from the DDT series contributed by each pathway for future on-site residents is shown in Table 6. Cancer risks and non-carcinogenic hazard indices contributed by each pathway are summarized in Tables 6-14 through 6-24 in the baseline risk assessment.

For the current scenario risk characterization calculations included adding the risks from PM-10 inhalation, soil dermal contact, soil ingestion, and deposited dust ingestion. The carcinogenic risks from the DDT series for all exposure scenarios are summarized in Table 7.

Hazard indices greater than 1.0 for the future industrial scenario were found for endosulfans, ethion, malathion, and DNOC. These values are summarized in Table 8.

Overall, the carcinogenic risks for all scenarios were found to be between 1×10^{-4} and 1×10^{-8}. Both current and future scenarios showed hazard indices greater than 1.0 for endosulfans, ethion, and malathion. The future industrial scenario also showed hazard indices greater than 1.0 for DNOC. In most cases, the high hazard indices are driven by the dermal exposure values. Although the cancer risks from the DDT series at this site were found to be approach EPA's acceptable risk range levels, noncarcinogenic risks were significantly above acceptable levels.

Uncertainty, Human Health

The toxicity information used for Superfund sites always includes a degree of uncertainty. Uncertainty must be addressed when dose-response data are used to model toxic effects to humans. Slope factors and reference doses incorporate uncertainty for: extrapolating from effects observed at high doses to effects observed at low doses, using animal studies to predict effects in humans, and using homogeneous animal or human populations to predict effects in heterogeneous human populations with a wide range of sensitivities.

Additional site-specific sources of uncertainty related to toxicity information is summarized below.

Sources of Uncertainty that May Underestimate Site Risks

Most groundwater monitoring wells were located to detect groundwater contamination originating from the former disposal pit. Groundwater data immediately downgradient of liquid

TABLE 5
SUMMARY OF SFS AND RFDS USED IN THE RISK ASSESSMENT

	SF $(mg/kg\text{-}day)^{-1}$	RfD (mg/kg-day)
DDT Series (all routes of exposure)	0.34	0.0005
Endosulfans (all routes of exposure)	NA*	0.00005
Ethion (all routes of exposure)	NA	0.0005
Malathion (all routes of exposure)	NA	0.02
DNOC, dermal	NA	0.001
Cadmium, oral	NA	0.0005
Chromium III (all routes of exposure)	NA	1.0

*No slope factor is available since these compounds are not considered carcinogens by these exposure routes.

TABLE 6

CANCER RISK FOR ON-SITE RESIDENTS
FUTURE EXPOSURE SCENARIO I

Exposure Pathways	ΣDDT	
	Average	Maximum
PM-10 Inhalation		
• mg/kg/day	1.1E-08	6.0E-07
• Modifying Factor	1.0	1.0
• CPF	0.34	0.34
• Risk	4E-09	2E-07
Soil Dermal Contact		
• mg/kg/day	1.3E-05	2.5E-03
• Modifying Factor	0.1	0.1
• CPF	0.34	0.34
• Risk	4E-07	8E-05
Soil Ingestion		
• mg/kg/day	1.6E-06	1.0E-04
• Modifying Factor	1.0	1.0
• CPF	0.34	0.34
• Risk	5E-07	3E-05
Ground-water Ingestion		
• mg/kg/day	3.2E-07	1.1E-05
• Modifying Factor	1.0	1.0
• CPF	0.34	0.34
• Risk	1E-07	4E-06
TOTAL RISK	1E-06	1E-04

TABLE 7

SUMMARY OF CANCER RISKS FROM DDT

	Average	Maximum
Current Scenario		
Off-Site Residents	1×10^{-7}	1×10^{-5}
Off-Site Industrial Workers	1×10^{-8}	1×10^{-5}
Future Residential Scenario		
On-Site Residents	1×10^{-6}	1×10^{-4}
Off-Site Residents	2×10^{-7}	2×10^{-5}
Off-Site Industrial Workers	2×10^{-8}	1×10^{-5}
Future Industrial Scenario		
On-Site Industrial Workers	9×10^{-6}	5×10^{-5}
Off-Site Industrial Workers	2×10^{-7}	2×10^{-5}
Off-Site Residents	2×10^{-8}	1×10^{-5}

TABLE 8

SUMMARY OF AVERAGE AND MAXIMUM
HAZARD INDICES GREATER THAN 1.0

	Endosulfans		Ethion		Malathion		DNOC	
	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.
Current Scenario								
Off-Site Residents	*	6.7	3.2	180	*	4.2	ND	ND
Off-Site Industrial Workers	*	2.8	*	75	*	*	ND	ND
Future Residential Scenario								
On-Site Residents	110	42,000'	7.1	1,100	*	110	ND	ND
Off-Site Residents	21	8,500'	1.4	230	*	44	ND	ND
Off-Site Industrial Workers	3.6	3,700'	*	93	*	9.5	ND	ND
Future Industrial Scenario								
On-Site Industrial Workers	*	290	*	370	*	6.4	2.6	370
Off-Site Industrial Workers	*	62	*	81	*	1.3	*	75
Off-Site Residents	*	140	2.2	180	*	6.0	5.8	360

Notes

* Hazard Index less than 1.0
ND Hazard Index not calculated for this pathway.
Ave. Average
Max. Maximum
\+ High Hazard Index due to dermal contact with and ingestion of on-site soil.

formulation areas is limited. In addition, not including all contaminants detected at the FMC Yakima site may underestimate risks. Only chemicals identified as contaminants of concern were evaluated.

Soil sampling to date has not included analyses for chromium VI. All risks are based on the assumption that the total chromium is chromium III. This is based on the assumption that chromium VI is rapidly converted to chromium III in soil. However, some chromium VI may be present in the soils.

The risk assessment only calculates risks for the exposure pathways that were judged to be complete. Additional pathways that potentially pose risks were not quantified. These pathways include food chain effects, dermal contact with contaminated groundwater, and contamination of home grown vegetables.

Sources of Uncertainty that May Overestimate Site Risks

Organic contaminants in soil and groundwater are generally subjected to a variety of degradation processes, including microbial actions, reduction-oxidation (redox) reactions, and volatilization. The groundwater model conservatively assumed that none of these processes occur.

The calculations of dermal exposure risks include a great deal of uncertainty, as the available data are extremely limited. Use of uncertainty factors and conservative assumptions in these cases may overestimate site risks.

The air dispersion model for the future residential scenario assumes that contaminated soils beneath existing structures are exposed and subjected to wind erosion. The model assumes that all these soils are contaminated.

Sources of Uncertainty that May Underestimate or Overestimate Site Risks

Sampling was based on known areas of contamination. This may overestimate site risks if additional areas are relatively uncontaminated, or underestimate risks if additional "hot spots" have not been detected. The use of standard EPA exposure assumptions for some of the land use scenarios may not be representative of the site and local conditions, and may also either overestimate or underestimate risks.

Overall, the baseline risk assessment for the FMC Yakima site includes many conservative assumptions that should prevent underestimation of site risks. However, EPA has performed additional studies on the risks posed by this site in an attempt to deal with some of the areas of uncertainty identified above. These additional studies are discussed below.

Human Health-Based Soil Concentrations

EPA contractors have recently completed studies that calculate health-based soil concentrations of site contaminants that would result in a 1×10^{-6} cancer risk, and a hazard index of 1.0. These calculations were based on risks to a child who lives on-site. This study used existing RI/FS documents, including the February 1990 soil sampling results. The study recommended the following:

- That dieldrin, ethyl parathion, and chromium VI be added as contaminants of concern
- That the health-based soil concentrations include carcinogenic risks based on inhalation of cadmium and chromium VI
- That DNOC should be considered as a contaminant of concern for ingestion

- That the final cleanup goals, due to the lack of verified data, not be based on dermal contact with soils

- That if risks from dermal contact with concrete are to be quantified, these risks should be based on wipe data (in $\mu g/100\ cm^2$), and not on core data (in mg/kg).

This information was used by EPA's contractors to calculate health-based soil concentrations. These concentrations were then considered by EPA in determining site-specific soil cleanup goals, which are shown in Table 9.

Human Health - Based Concrete and Structures Concentrations

EPA contractors also developed health-based surface concentrations, in $\mu g/100\ cm^2$, for contaminated concrete and structures. These levels are based on current EPA guidance, and are calculated to result in a 1×10^{-6} cancer risk, and a hazard index of 1.0. Contaminants of concern for concrete and structures are shown in Table 10.

Conclusions for Human Health Risk Assessment

Overall, the human health risk assessment shows that concentrations of pesticides in soil exceed acceptable risk levels, and pose a threat to human health for both current and future land use scenarios.

Based on information presented in the risk assessment, information developed by EPA contractors, and current EPA guidance, health-based cleanup levels for contaminated soils and concrete were determined. These cleanup levels will be used during remedial actions to designate soil and debris in need of remediation. Cleanup goals will be adjusted where multiple contaminants are found. Adjusted goals will be protective of human health at a cumulative excess cancer risk of 1 in a million, or a cumulative hazard index less than or equal to 1, whichever is lower.

Environmental Evaluation

Contaminant Identification

The risk assessment for the FMC Yakima site includes an environmental evaluation that identifies potential environmental threats from the site. The contaminants of concern for the environmental evaluation are the DDT series, endosulfans, ethion, malathion, and zinc.

Physical Setting and Critical Habitats

The study area for the environmental evaluation includes the FMC Yakima site and a one-mile radius around the site. The site is a two-acre paved and fenced area where pesticide formulation activities formerly took place. An eight-acre field is located to the east and south of the site. The field is covered predominantly with weedy forbs and grasses, litter, and pebbles. Several wetland areas are located south and southeast of the site. The closest downgradient wetland identified by the National Wetlands Inventory occurs approximately 1200 feet south of the site. Cattle pastures are located south of the site, and south of the wetland areas. The Yakima River is approximately 1.5 miles to the east of the site. No sensitive habitats, or state- or federally-listed threatened or endangered species or other species of concern are known to occur on the site or in the study area.

Wildlife that have been observed at the site include quail (Lophortyx californicus), house finch (Carpoedacus mexicanus), starling (Sturnus vulgaris), black billed magpie (Pica pica),

TABLE 9

HEALTH - BASED CLEANUP LEVELS FOR CONTAMINATED SOIL

Compound	Concentration (mg/kg)
DDD	5.1
DDE	3.6
DDT	3.6
Dieldrin	0.076
Cadmium	8.0
Chromium VI	1.0
Endosulfans	4.2
Ethion	42.4
Malathion	1695.0
Ethyl Parathion	11.0
DNOC	8.5
Zinc	500.0

Cleanup goals will be adjusted where multiple contaminants are found.

TABLE 10

HEALTH - BASED CLEANUP LEVELS FOR CONTAMINATED CONCRETE AND SURFACES

Compound	Concentration ($\mu g/100\ cm^2$)
DDD	6.5
DDE	4.6
DDT	4.6
Dieldrin	0.1
Endosulfans	10.0
Ethion	270.0
Malathion	8,200.0
Ethyl Parathion	2,400.0

Cleanup goals will be adjusted where multiple contaminants are found.

kestrel (Falco sparverius), and insects. Evidence of rabbit (Sylvilagus sp.) and owl have been noted.

There are no wetlands on-site, however, the wetlands in the vicinity of the site may provide seasonal habitats for shorebirds and waterfowl, including the mallard duck (Anas platyrhynchos). Resident species of the wetland areas may include the muskrat (Ondatra zibethicus), short-tailed weasel (Mustela erminea), frogs, and passerine birds.

The Yakima River provides habitat for three Washington State fish species of concern. These are the sandroller sucker (Percopsis transmontana), mountain sucker (Catostomus platyrhynchus), and Paiute sculpin (Cottus beldingi). The riparian habitat supports overwintering raptors, including bald eagles (Haliaeetus leucocephalus), rough-legged hawks (Buteo lagopus), and red-tailed hawks (Buteo jamaicensis), and provides nesting sites for ospreys (Pandion haliaetus), shorebirds, and water fowl. A great blue heron (Ardea berodius) rookery occupies a site along the Yakima River, approximately 2.5 miles southeast of the site.

Ecological Exposure Assessment

The exposure scenario for the ecological assessment assumes current conditions. The area around the wetlands is industrial with some domestic use. The wetlands fluctuate four to six feet each year with the irrigation season (levels rise during the summer). The current environmental scenario assumes the following:

- That aquatic organisms (fish and invertebrates) reside in the wetlands
- That the wetlands are downgradient and hydraulically connected to the groundwater beneath the site.

It should be noted that off-site wetlands have not been sampled for contaminants, or for biota, and that the hydraulic connection required to complete an exposure pathway between the groundwater beneath the site and the wetlands has not been established. Rather, the Environmental Evaluation focused on potential impacts suggested by a conservative groundwater model to a wetland located 1200 feet southeast of the FMC Yakima Site. Wells recently installed to evaluate potential off-site transport of contaminants of concern indicate that groundwater downgradient of the site, in the direction of the wetland, is of a higher quality than that found in the vicinity of the former formulation areas of the plant, and would not be expected to exert an impact on the wetlands downgradient. Future groundwater monitoring is expected to confirm this assessment.

Exposure Pathways and Exposure Concentrations

Exposure point concentrations of contaminated groundwater at the wetland and the Yakima River are based on a groundwater transport model. The source concentrations for the model were based on results of groundwater sampling, including results prior to excavation of the former disposal pit. Both average and maximum concentrations were used in the model. The model assumes that a source equivalent to the former disposal pit still exists, and that source reduction is 50 percent at 100 years. The model used groundwater monitoring results, and assumed retardation factors, to obtain exposure average and maximum concentrations in the wetland, and in the Yakima River. The concentrations at the river do not include dilution, which would reduce concentrations by a factor of 1,000 to 10,000.

Exposure concentrations of zinc were not modeled. The exposure assessment assumed that the concentrations detected in the wetland were the same as the concentrations detected in the groundwater at the FMC Yakima Site.

Toxicity Assessment

This section of the Environmental Evaluation reviews the available toxicological data, provides a rationale for selection of the species of concern (indicator species), and discusses regulatory criteria and derivation of ecological health-based criteria.

Toxicological Profiles

DDT has been found to be toxic to fish and other aquatic organisms. It bioaccumulates and has severe food chain impacts. DDT impairs avian reproduction by causing eggshell thinning and increased embryo mortality. Raptors have been found to be extremely susceptible to eggshell thinning effects of DDT. Fish-eating raptors were chosen as the indicator species because of their sensitivity to toxic effects of DDT. The Water Quality Criterion for DDT for the protection of freshwater aquatic life is 0.001 μg/L. This concentration was judged to also be protective of fish-eating raptors.

Endosulfans have been found to cause toxic effects in aquatic organisms including liver changes in fish. Endosulfans bioaccumulate at much lower concentrations than DDT, and have not been documented as causing the same severe reproductive effects in birds. Fresh water fish were chosen as the indicator species for endosulfans. The Water Quality Criterion for endosulfans for the protection of freshwater aquatic life is 0.056 μg/L, and this concentration was also used as the ecological health-based criterion.

Ethion has been found to be toxic to aquatic invertebrates, such as Daphnia, which were chosen as the indicator species. No Water Quality Criterion for ethion has been established. The Environmental Evaluation uses 0.056 μg/L as the ecological health-based criterion.

Malathion has been found to be toxic to some species of fish, and to aquatic invertebrates. Aquatic invertebrates were chosen as the indicator species because of their sensitivity to malathion, and the Water Quality Criterion for the protection of freshwater aquatic life of 0.1 μg/L was used as the ecological health-based criterion.

Zinc has been found to be toxic to aquatic microorganisms (including algae), invertebrates, and fish. The toxicity of zinc increases with decreasing water hardness. Fish were chosen as the indicator species because of their sensitivity to zinc, and the Water Quality Criterion for the protection of freshwater aquatic life of 47 μg/L was used as the ecological health-based criterion.

Risk Characterization

Hazard indices were computed for the contaminants of concern using the ecological health-based criteria and the exposure point concentrations (where the ecological hazard index = E/ecological health-based criterion, and E = the exposure point concentration. This information is shown in Table 11 which shows that the hazard indices range from 0.7 (based on an average concentration for malathion) to 389 (based on a maximum concentration for DDT).

Conclusions for the Environmental Evaluation

Pesticides and zinc at the FMC Yakima site may pose threats to freshwater aquatic life based on conservative modeling assumptions and ecological health-based criteria. However, wells recently installed between the site and adjacent wetlands show lower levels of contaminants than the conservative model predictions and actual impacts on aquatic ecosystems is not expected to be significant.

TABLE 11

RISK CHARACTERIZATION FOR ECOLOGICAL INDICATOR SPECIES IN THE WETLAND

Chemical	Indicator Species	Health-Based Water Criteria * (µg/l)	Exposure Point (a) Concentration (µg/l) in Water		Hazard Index (b)	
			Average	Maximum	Average	Maximum
Current Scenario						
ΣDDT	Fish-eating raptor	0.001	0.019	0.389	19	389
ΣEndosulfan	Fish	0.056	0.026	0 265	0 5	4.7
Ethion	Aquatic invertebrate	0.056	0 067	0.147	1 2	2 6
Malathion	Aquatic Invertebrate	0.1	0.067	0.147	0 7	1 5
Zinc	Fish	47	1.744(c)	6500(c)	37	138

Notes:

a Modeled concentrations at the wetland. Transport model assumes the wetland is directly downgradient and hydraulically connected to the site.

b Hazard Index = Exposure point concentration/health based criterion

c Concentrations are from the on-site monitoring wells; they are not modeled concentrations at the wetland

* Ambient Water Quality Criteria for Protection of Aquatic Organisms - Chronic

Uncertainty

Many of the sources of uncertainty identified in the human health section are applicable to the environmental evaluation. Additional sources of uncertainty are listed below:

No sampling was done at the wetland to identify contaminant concentrations or resident biota. This may contribute to underestimating risks if contaminant concentrations are high. If the wetland does not provide habitat for the ecological endpoints and receptors identified in the Environmental Evaluation, or if potential migration pathways and assumptions are inaccurate, risks may be overestimated.

Because the wetland is located in an industrial area, it is potentially subjected to sources of contamination other than the FMC Yakima site. If this is the case, then the environmental evaluation may underestimate the total risks at the wetland.

The hydraulic connection between the wetland and groundwater beneath the site has not been established. This may overestimate risks if the wetland is not directly downgradient of the site. Also, many of the modeling assumptions, such as source size, are conservative and may overestimate risks.

Summary of Threats to Human Health and the Environment

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

VII. DESCRIPTION OF ALTERNATIVES

Alternative 1: No Action

Evaluation of the "no action" alternative is necessary to allow evaluation of site conditions with limited remedial measures, and to compare the benefits of other alternatives. Under the "no action" alternative, conditions at the site would remain as they are now. The existing structures would remain as they now stand, and contaminated soils would remain in place. The existing fence would be maintained to prevent access by unauthorized personnel. Long-term groundwater monitoring (20 years) would be necessary, since a source of further contamination would remain. A deed restriction limiting the future use of the site would also be required. The following costs were estimated for this alternative:

Capital Cost	none	
Annual Operation & Maintenance		$33,000
Present Worth (O & M)	$432,000	
Total Cost	$432,000	

The present worth of O & M is based upon a 20 year amortization at 5% interest for all alternatives.

Alternative 2: Capping of Soils and Encapsulation of Concrete Pads and Structures

Under this alternative, selected areas of the site (i.e. those above cleanup goals) would be capped, and contaminated concrete pads and structures would be encapsulated with concrete. The former disposal pit would be backfilled. The contaminants would remain on-site, buried beneath the cap, but they would not be expected to affect groundwater substantially, because the cap would minimize stormwater infiltration and, therefore, contaminant migration. Long-term groundwater monitoring would be necessary, and several wells would be added to the existing

network to track any migration of pollutants. The security fence would be maintained, and a deed restriction to limit future development of the site would be imposed. Continued inspection and maintenance of the cap would also be required. The following costs were estimated for this alternative:

Capital Cost	$321,000	
Annual Operation & Maintenance		$36,000
Present worth (O & M)	$471,000	
Total Cost	$792,000	

Alternative 3: Excavation, Soil Washing and Waste Sludge Treatment; Demolition or Gritblasting of Contaminated Soils and Concrete Structures

Contaminated soils would be excavated and would undergo soil washing as a volume reduction, or fractional segregation process. Since the contaminants tend to adhere to fine particles, these would be separated out, resulting in a volume reduction of 75 to 80 percent. The resulting waste sludges would be thermally treated at an off-site incinerator. The washing fluid (water, possibly with additives) would be recycled through the system. A smaller soil volume, of higher moisture content, would require incineration. Contaminated concrete would be demolished or gritblasted and disposed of off-site.

The contaminated soils at the FMC site consist predominantly of clayey sands and gravels. The general size reduction would be accomplished through a series of physical separation procedures, using commercially available size-reduction and separation equipment. The screened soils would undergo additional size separation using settling equipment such as a sedimentation tank or a hydrocyclone. The fines could be further separated from the coarse materials through a series of flotation cells. The waste sludges would be collected and filtered to reduce water content prior to treatment. The clean materials (coarse fraction) would undergo liquid/solid separation using clarifiers, followed by a belt filter press. The separated solids would be stockpiled and tested prior to placement as clean fill. The wash-water stream would be recycled and, after completion of the project, the water would be decontaminated by carbon adsorption or other suitable means.

The sludge would be treated off-site using rotary kiln incineration. The off-site incinerator would have the 99.99% destruction and removal efficiency (DRE) required by RCRA for organic wastes. The ash residue would be stabilized and placed in a permitted disposal facility. Contaminated concrete structures would be gritblasted or demolished and incinerated or disposed of in a secure landfill. Since all of the soils having concentrations of contaminants above health-based levels would be excavated and treated, this alternative would meet the requirements for clean closure under RCRA Subtitle C. Soil sampling and analysis, as well as groundwater monitoring to confirm complete source removal, would be performed. Several more monitoring wells would be installed to ensure that the aquifer is adequately characterized. A gradual decrease in the already low levels of groundwater contaminants would be expected to take place over time, once the source is removed. The following costs were estimated for the remediation of 900 cubic yards of contaminated soils and other structures:

Capital Cost	$1,202,000	
Annual Operation & Maintenance		$33,000
Present worth (O & M)	$432,000	
Total Cost	$1,634,000	

Alternative 4: Excavation and Vitrification of Contaminated Soils and Concrete Structures

Contaminated soils would be excavated and placed in prepared trench areas. Electrodes inserted into the soil would heat the contaminated soil to its fusion point, and the contaminated soil would be converted into a chemically inert, stable, glass-like, crystalline product. Inorganic

elements would be incorporated into the vitrified mass, and organic components would be pyrolized. The pyrolized byproducts would migrate to the surface of the vitrified zone, where they combust in the presence of oxygen. The combustion gases are drawn into an off-gas treatment system. The destruction and removal efficiency (DRE) of the vitrification process would be expected to meet the RCRA requirement of 99.99% for the site contaminants. The volume of the excavated soil would be reduced by approximately 30%. Previous testing conducted by the vendor of this process has shown successful pyrolysis of organic constituents, including organochlorine compounds.

The contaminated concrete would be demolished or gritblasted, and the resulting waste would be added to the soil to be vitrified. The vitrified wastes would remain buried on-site, approximately one foot below the surface. If the vitrification were successful in meeting performance standards, the site would then be considered to have attained clean closure under RCRA Subtitle C. Long-term groundwater monitoring to confirm that the inorganic contaminants were not leaching from the vitrified mass might still be warranted. Additional wells would be installed to expand the groundwater monitoring program to ensure that aquifer conditions would be adequately assessed. A gradual decrease in the already low levels of groundwater contaminants would be expected to take place over time, if the vitrification process is effective. The following costs were estimated for the remediation of 900 cubic yards of contaminated soils and other structures:

Capital Cost	$1,138,000	
Annual Operation & Maintenance		$33,000
Present worth (O & M)	$432,000	
Total Cost	$1,570,000	

Alternative 5: Excavation and Off-Site Incineration of Contaminated Soils; Demolition or Gritblasting of Concrete Structures

Under this option, contaminated soils would be excavated and transported to an off-site facility and incinerated. Prior to off-site shipment, the contaminated soils would be screened to remove particles too large for feeding into the rotary-kiln incinerator. These particles would be analyzed and, if necessary, crushed and shipped to the incinerator. Other process requirements may include blending, drying, and/or chemical characterization. The incinerator would have a destruction efficiency of 99.99% for organic wastes, as required by RCRA. The ash residues would be stabilized and disposed of at a permitted waste disposal facility. Contaminated concrete structures would be gritblasted or demolished and would also be disposed of in an off-site secure landfill. Groundwater monitoring through the existing network of wells would be conducted to confirm complete source removal. Additional wells would be installed to expand the groundwater monitoring program, in order to ensure that aquifer conditions would be adequately assessed. A gradual decrease in the already low levels of groundwater contaminants would be expected to take place over time, once the source is removed. The following costs were estimated for the remediation of 900 cubic yards of contaminated soils and contaminated concrete structures:

Capital Cost	$2,526,000	
Annual Operation & Maintenance		$33,000
Present worth (O & M)	$432,000	
Total Cost	$2,958,000	

Alternative 6: Excavation and On-Site Incineration of Contaminated Soils; Demolition of Contaminated Concrete Structures and Disposal at a Secure Landfill

Contaminated soils would be excavated, and contaminated concrete structures would be demolished and prepared for incineration, or if the volume of concrete requiring treatment was insufficient to justify the mobilization of appropriate crushing equipment, would shipped to an off-site secure landfill. A mobile rotary-kiln incinerator would be transported to the site. The

VESTA system (VESTA Technology, Ltd.) was used to develop this alternative. This system has been operated at a Superfund site in the State of Washington and has demonstrated a destruction and removal efficiency of 99.99%, as required by RCRA for organic wastes. Prior to incineration, contaminated soil and debris would be screened to remove oversized particles. Solid materials must be reduced to less than 2 inches in diameter for feeding into the rotary kiln. Oversized material would be segregated for further characterization and, if required, the material would be crushed and fed into the incinerator.

Following incineration, the ash would be analyzed to determine degree of contaminant destruction and leachability. If health-based cleanup goals are met the ash will be considered to be delisted and used for backfill on site. However, because certain heavy metals have been identified as possible site contaminants, delisting of the treated waste may not be possible. In that case, the treated wastes would be stabilized and landfilled at a permitted RCRA hazardous waste disposal facility. Several additional wells have recently been installed, and groundwater monitoring would be conducted to confirm that source removal is complete, and that RCRA clean-closure criteria have been met. A gradual decrease in the already low levels of groundwater contaminants would be expected to take place over time, once the source is removed. The following costs were estimated for the remediation of 900 cubic yards of contaminated soils and the contaminated concrete structures:

Capital Cost	$1,323,000	
Annual Operation & Maintenance		$33,000
Present worth	$432,000	
Total Cost	$1,755,000	

Alternative 7: Excavation, Stabilization and Off-Site Landfilling of Contaminated Soils; Demolition and Off-Site Landfilling of Concrete Structures

Contaminated soils would be excavated, and concrete structures would be demolished or gritblasted. The soils would be screened to remove oversized particles, loaded onto trucks, and transported to an off-site permitted RCRA facility for stabilization and disposal. No site-specific stabilization treatability studies have been conducted; however, similar wastes from other sites have been successfully stabilized. The disposal facility would conduct a treatability study to determine the optimum treatment formulation prior to the commencement of the remedial action. A Treatability Variance (40 CFR §268.44) would be required to implement this option because stabilization is not likely to meet Land Disposal Restriction standards for the site organic contaminants. Groundwater monitoring would be conducted in order to confirm that source removal is complete, and that clean closure criteria have been met. Several additional wells would be installed to expand the groundwater monitoring program in order to ensure that aquifer conditions would be adequately assessed. The following costs were estimated for the remediation of 900 cubic yards of contaminated soils and contaminated concrete structures:

Capital Cost	$626,000	
Annual Operation & Maintenance		$33,000
Present worth (O & M)	$432,000	
Total Cost	$1,058,000	

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Each of the seven alternatives described in the preceding section was evaluated according to the nine criteria defined below. Each criterion is discussed in detail on the pages that follow this list.

Threshold Criteria

1. **Overall protection of human health and the environment** - addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls or institutional controls.

2. **Compliance with federal and state environmental standards** - addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements (ARARs) of other Federal and State environmental statutes and/or provide grounds for invoking a waiver.

Primary Balancing Criteria

3. **Long-term effectiveness and permanence** - refers to the magnitude of remaining risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

4. **Reduction of toxicity, mobility, and volume** - is the anticipated performance of the treatment technologies that may be employed in a remedy.

5. **Short-term effectiveness** - refers to the speed with which the remedy achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment during the construction and implementation period.

6. **Implementability** - is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.

7. **Cost** - includes capital and operation and maintenance (O & M) costs.

Balancing criteria 3 and 4 receive added emphasis in evaluating alternatives.

Modifying Criteria

8. **State acceptance** - indicates whether the State concurs with, opposes, or has no comment on the preferred alternative.

9. **Community acceptance** - will be assessed following a review of the public comments received on the RI/FS report and the Proposed Plan.

Overall Protection of Human Health and the Environment

According to the risk assessment (Bechtel, Phase II Remedial Investigation Report, April 1990), direct contact with surface soils is the most significant exposure pathway of concern at the FMC site. All of the alternatives presented would prevent direct contact, except by trespassers in the case of Alternative 1. Inhalation of contaminated soil particles is also an exposure pathway. All of the alternatives except Alternative 1, would also eliminate this pathway. The risk assessment states that, at the present time, the levels of contaminants in the groundwater do not pose a risk, however, if the contaminated materials are left in place, groundwater contamination may increase to levels that pose a health risk. Alternatives 3 through 7 reduce the risks posed by all of the exposure pathways at the site through excavation and treatment of contaminated materials. Alternative 2 would tend to minimize groundwater contamination by eliminating infiltration of stormwater. As long as the capped areas remained undisturbed, a high degree of protection would be provided by Alternative 2.

Overall protection of human health and the environment at the site is increased by the alternatives involving excavation and treatment of the contamination. Alternatives 3, 5 and 6 offer the highest degree of protection, since the contaminants would be permanently destroyed.

Of these, Alternative 6 would be slightly more protective, because the risks associated with loading contaminated materials onto trucks and transporting the materials over long distances would be eliminated.

Alternatives 4 and 7 are protective treatment technologies associated with varying levels of uncertainty. If Alternative 4 were employed, there is a possibility that inorganic contaminants could leach from the vitrified mass buried on site and cause groundwater contamination. Since the contaminated materials would be excavated and removed from the FMC site, Alternative 7 would be protective of human health and the environment at the site, but any future problems associated with the stabilized waste would be transferred to another location.

Alternative 2 would also be adequately protective as long as the cap remained intact, since dermal contact, inhalation of contaminated soil particles, and further infiltration of contaminants to the groundwater would be prevented. Alternative 1 is limited to maintenance of a fence to prevent direct contact with contaminated soils, and groundwater monitoring. The monitoring data would be used to prevent consumption of contaminated water, but Alternative 1 would not provide any protection from airborne contaminated soil particles.

Compliance with ARARs

Alternatives 1 through 7 all have the potential to meet existing chemical-specific ARARs for groundwater since currently detected levels of contaminants have not been shown to exceed Safe Drinking Water Act standards. The State of Washington Model Toxics Control Act has been considered in evaluating alternatives with respect to the chemical specific cleanup goals presented for soil and groundwater; it is noted, however, that these regulatory standards have not yet been promulgated. No federal chemical specific cleanup standards for contaminated soil or concrete have been promulgated, however, chemical specific RCRA Land Disposal Restrictions may be applicable.

The remedial actions specified in Alternatives 2, 3, 4, 5, 6, and 7 would trigger action-specific ARARs. RCRA landfill closure regulations would be considered relevant and appropriate for alternative 2. Land Disposal Restrictions specified in RCRA would be considered an action specific ARAR for options 3 -7 since all of these alternatives involve excavation and treatment and/or disposal of a RCRA listed waste. RCRA clean closure requirements are relevant for alternatives 3-7. A Treatability Variance (40 CFR §268.44) would be required in order to implement Alternative 7, because stabilization is not likely to meet Land Disposal Restrictions for the site organic contaminants. Alternatives 3, 4, 5, and 6 employ thermal destruction technologies. In the State of Washington these alternatives would require compliance with federal and state air standards administered by the local air pollution authority. Off-site incineration would be conducted at a permitted incinerator meeting applicable State, Federal, and local regulations. Technologies involving incineration must also meet the RCRA requirement of a 99.99% destruction and removal efficiency (DRE).

Long-Term Effectiveness and Permanence

In the absence of any prior remedial activities, the no-action and capping alternatives (1 and 2) would not meet the goals or intent of CERCLA or the NCP, as a permanent remedy. However, the two pit excavations that took place in 1988 and 1989 removed the major source of contamination at the site and are considered part of the remedial action for the site.

Alternative 2 is not a permanent solution. Since the asphalt cap would require continual maintenance, and groundwater monitoring would also be required for an extended period of time. In addition, since the water table is only several feet below the ground surface and has seasonal fluctuations, enough contamination could enter the groundwater to require remediation. Alternative 1 is ineffective in meeting remedial action objectives.

Alternatives 3, 5, and 6 are final, permanent remedies. Alternative 7 would be the least favored of the treatment alternatives, for although it would be a permanent solution for the site itself, waste would be transferred off-site, requiring long-term monitoring and potential future remediation at another location. It is uncertain whether Alternative 4 would be a permanent solution, because the vitrification technique has never been used at a full-scale site, and limited information is available. Even if organic contaminants are successfully destroyed and the inorganic contaminants were effectively bound up in the vitrified mass, this method would still limit future use of the site, because the material would remain buried on-site.

Reduction of Toxicity, Mobility, and Volume

Alternatives 3, 5, and 6, all involving incineration, meet all of these goals. Alternative 4 would reduce toxicity and mobility if the vitrification were successful, but volume would only be reduced by approximately 30 percent. Alternative 7, off-site solidification and land disposal, would reduce the mobility and toxicity, but not the volume, of the waste. Alternative 2, capping, employs no treatment technologies and would only reduce mobility. Because the waste would remain in place, neither its toxicity nor its volume would be reduced. Alternative 1, no action, would not meet any of the reduction goals.

Short-Term Effectiveness

It is estimated that any of the alternatives could be accomplished within one construction season after beginning remediation. A potential for worker and community exposure by inhalation of contaminated dust during excavation exists for all of the alternatives involving excavation of the contaminated soils and demolition or gritblasting of the contaminated structures (Alternatives 3 through 7). Alternatives 4 and 6, involving on-site treatment, would require strict air pollution engineering controls to reduce the exposure potential. Alternatives 5 and 7, involve transporting a large volume of contaminated soil, which would increase community exposure, as well as causing traffic congestion and risk of accident. Considering these exposure risks, Alternative 2 probably is the most protective on a short-term basis, because the contaminated soils would only be minimally disturbed during the remedial process. Some dust would be created during the asphalting process, but that could be minimized through dust-control practices.

Implementability

All alternatives under which contaminants would remain on site would require a restriction to be placed in the property deed. This would limit future use of the land, potentially reducing its value. Alternatives 1, 2 and 4 would require a deed restriction limiting the future use of the site property. Further, use of institutional controls such as a deed restriction, in lieu of treatment, are disfavored under the NCP as recently amended.

Any of the other alternatives could be implemented. Alternatives 3, 5, and 6 rely on incineration, which is considered the Best Demonstrated Achievable Technology (BDAT) for the organic site contaminants. Incineration is a commercially available technology which has been proven effective for destruction of such contaminants. Emission testing would be required before full scale remediation could begin to confirm compliance with applicable air standards. Prior to the implementation of Alternative 3 a treatability study would be required. Treatability studies would also be required for Alternatives 4 and 7. The excavation phase of Alternatives 3 through 7 should be conducted during the low water table season. For Alternative 4, it would also be necessary to conduct the treatment phase during the low water table season in order to maximize the depth of the vitrification trenches.

Cost

Alternative 1 is the least expensive, followed by Alternative 2. The estimated cost of Alternative 6 is somewhat higher than all of the other alternatives, with the exception of Alternative 5, which is much more expensive. However, as the volume of soil to be remediated increases, the cost-effectiveness of on-site incineration also increases. It may therefore prove less expensive than Alternatives 3 or 4, which have similar cost estimates (see Table 12). Further, since the effectiveness of alternatives such as soil washing, vitrification, stabilization, and encapsulation is uncertain, these alternatives may involve unforseen costs, should complications arise.

Costs of the 7 alternatives, as estimated by Betchel in the Feasibility Study, for three different excavation volumes, are presented in Table 12. These estimates include annual operation and maintenance costs that assume groundwater monitoring over a 20-year period for all of the alternatives. This cost, at a present worth discounted at a rate of 5% for 20 years, was calculated to equal $431,816 for all of the alternatives except capping, which includes asphalt cap maintenance and has a slightly higher cost of $471,072. The alternatives involving excavation of the contaminated soils and incineration or removal of contaminants from the site (Alternatives 3, 5, 6, and 7) will not require long-term monitoring. Only groundwater monitoring to ensure that the excavation has been complete is expected to be required. Alternative 4, which involves leaving the vitrified contaminants buried on-site, may require long-term monitoring. Therefore, the operation and maintenance portion of the cost estimates for Alternatives 3, 5, 6, and 7 should be lower than presented.

Another cost consideration which was not factored into the cost analysis is the deed restriction that would be necessary if the waste were left on site. Since that would potentially lower the property value, it would increase the total cost of Alternatives 1, 2 and 4 by an unknown amount. There could also be costs associated with future liability for Alternative 7 due to off-site disposal of hazardous materials, or with Alternative 4, if the vitrification process were not completely effective.

State Acceptance

The State of Washington has been involved in RI/FS activities, development of ARARS, participated in the remedy selection process and concurs with the selected remedy. The State is expected to participate in the Consent Decree negotiations with EPA, DOJ, and FMC.

Community Acceptance

The community is supportive of the selected remedy. EPA met with local and state health department officials, conducted a public meeting in Yakima, and solicited written comments on the remedial alternatives. EPA received correspondence from the Washington Environmental Council supporting the preferred alternative and the cleanup levels. No comments were received that disagreed with the selected remedy or the proposed cleanup levels.

IX. THE SELECTED REMEDY

Alternative 6 has been selected as the remedial alternative to be employed at the site. Contaminated soils and structures throughout the site will be addressed by this remedial action. The only significant risks currently posed by the FMC site are associated with the contaminated soils and structures. Concentrations of contaminants in groundwater are currently below health-based levels, and do not require treatment. An expanded monitoring well system will be used to confirm complete source removal and to verify that unacceptable levels are not present. If monitoring shows groundwater remediation to be necessary, it will be conducted as part of a separate operable unit of the site remediation.

TABLE 12
COSTS OF REMEDIAL ALTERNATIVES *

Alternative	Remediation of 900 cubic yards	Remediation of 2000 cubic yards	Remediation of 4000 cubic yards
1. No Action	$432,816	$432,816	$432,816
2. Capping	$792,237	$792,237	$792,237
3. Soil Washing and Incineration	$1,634,138	$2,942,390	$4,377,626
4. In Situ Vitrification	$1,569,722	$2,121,218	$3,571,634
5. Off-Site Incineration	$2,958,203	$5,899,058	$8,770,058
6. On-Site Incineration	$1,754,363	$2,859,098	$3,753,002
7. Stabilization and Off-Site Disposal	$1,058,010	$1,653,014	$2,169,134

* As estimated by Bechtel Environmental, Inc., April 1990 Feasibility Study, FMC, Yakima.

The selected remedy consists of:

- Sampling of soils and concrete structures to refine the current estimate of the lateral and vertical extent of material requiring treatment.
- Excavation of contaminated soils to the concentrations shown in Table 9.
- On-site incineration of contaminated soils.
- Dismantling contaminated slabs and portions of the buildings that are determined to exceed cleanup goals shown in Table 10. Where the removal of a portion of a building affects the safety or structural integrity of that building appropriate repairs will be made.
- On-site incineration of contaminated concrete and debris or disposal at a RCRA-Subtitle C permitted hazardous waste disposal facility, depending on volume.
- Following incineration, the ash will be analyzed to determine degree of contaminant destruction and leachability. If health-based cleanup goals are met the ash will be considered to be delisted and used for backfill on site.
- Continued groundwater monitoring to confirm source removal.

Characterization

Before beginning the remedial design phase, sampling of contaminated soils and structures will be performed in order to further refine the volume of material above cleanup levels requiring treatment.

Surface and subsurface soils will be sampled and analyzed in the following areas (refer to Figure 2 for locations):

Areas 2: Soils underlying the southeast corner of the warehouse
Areas 3: East side of warehouse
Areas 4: Refuse and drum storage area
Areas 5: Tank farm and sumps
Areas 6: Barrel wash area
Areas 7: Liquid formulary area
Areas 8: Elgetol area
Areas 9: Unpaved area west of elgetol area

During the design phase, contaminated structures will also be sampled. Concrete throughout the warehouse will be wipe sampled and analyzed to determine the magnitude of removal operations.

Remediation of Concrete Structures

The effect of removal of contaminated portions of each building will be analyzed. If it is determined that removal of an area of contaminated concrete will compromise the safety or structural integrity of a structure, that portion of the structure will be immediately repaired. The contaminated concrete that is removed will be stockpiled. If there is sufficient volume to justify mobilization of appropriate crushing and related dust control equipment, the stockpiled material will be crushed and fed to the incinerator. If the final volume is too small to justify mobilization of crushing equipment a treatability variance will be prepared to support off-site disposal. Best Management Practices will be undertaken, consistent with Land Disposal Restrictions, prior to

off-site disposal. Appropriate measures will be taken to ensure that contaminated particles do not become airborne. Post-remedial sampling and analysis will be conducted to confirm complete removal. Figure 3 is a flowchart illustrating the decision process.

Remediation of Soils

Contaminated soils will be excavated and then screened to separate those particles too large to feed into the rotary kiln incinerator. Screened materials (greater than two inches in diameter) will be stockpiled. These materials will be analyzed to determine if on-site disposal is acceptable. If these cobbles are contaminated above health-based levels, they will be crushed and incinerated or disposed of in a permitted hazardous waste disposal facility as outlined in the paragraph above on off-site disposal of concrete. Appropriate measures will be taken to ensure that contaminated particles do not become airborne. Post-remedial sampling and analysis to confirm complete removal will be conducted. Figure 4 is a flowchart illustrating the decision process.

Incineration

The rotary kiln incinerator that will be employed at the site will have a past record of acceptable destruction of the site's contaminants of concern. Performance testing will be conducted to ensure that air emissions meet all applicable, relevant, and appropriate requirements (ARARs). Emission testing will include sampling for site contaminants and appropriate degradation by-products. At least one set of samples being evaluated for dioxins and furans.

Ash Disposal

Following incineration, the ash would be analyzed to determine the degree of contaminant destruction and leachability. If health-based cleanup goals are met the ash will be considered to be delisted and used for backfill on site. However, because certain metals have been identified as possible site contaminants, delisting of the treated waste may not be possible. In that case, the treated wastes would be stabilized and landfilled at a permitted RCRA hazardous waste disposal facility.

Groundwater

Wells will be sampled and analyzed quarterly for two years, then annually for an additional three years. A reassessment of the need for groundwater remediation would be triggered by two consecutive exceedances of the concentrations of indicator parameters representing the 10^{-6} carcinogenic risk level or a 1.0 Hzard Index. These levels are 0.1 μg/L for DDT and 2.0 μg/L for endosulfans. This would prompt a further evaluation of the groundwater conditions to determine whether groundwater remediation is necessary. If such additional remediation is necessary, it will be the subject of a subsequent ROD and consent decree or unilateral administrative order, or may be pursuant to the original consent decree.

All monitoring data will be reviewed at the end of five years. If the health-based concentrations in groundwater are not exceeded, and if levels show a decreasing trend as expected, groundwater monitoring will be discontinued after the five-year observation period. The site will then be considered to be clean closed under the requirements of RCRA.

X. STATUTORY DETERMINATIONS

Protection of Human Health and the Environment

The selected remedy will provide long-term protection of human health and the environment by removing the contaminated soil and eliminating it as a source of groundwater

FIGURE 3
DECISION FLOW CHART FOR CONTAMINATED STRUCTURES

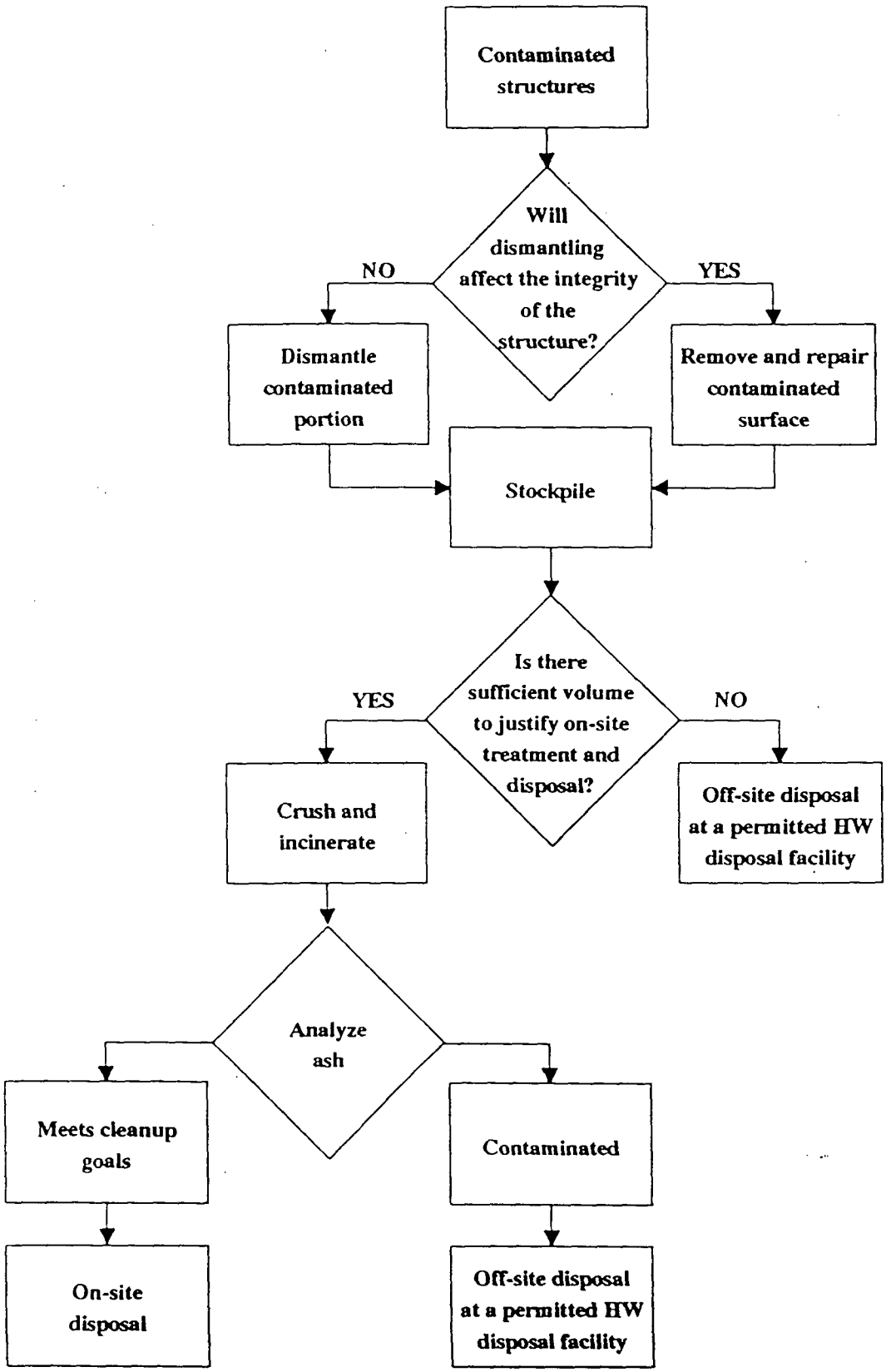
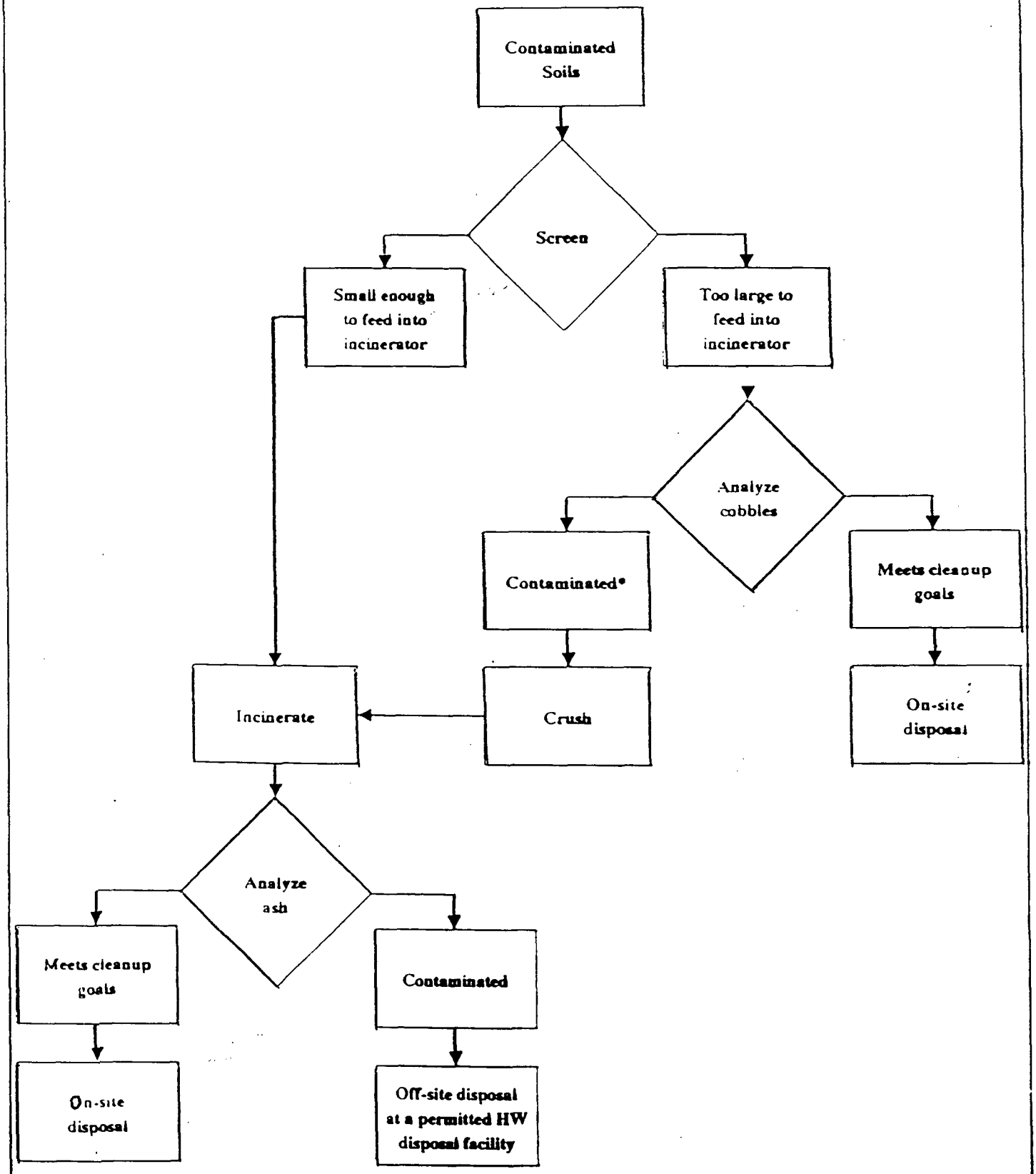


FIGURE 4
DECISION FLOW CHART FOR CONTAMINATED SOILS



* Contaminated at concentrations above health-based clean-up goals.

contamination. These measures will eliminate the exposure routes of inhalation and ingestion ofcontaminated soil particles, dermal contact with contaminated soil, and ingestion of contaminated groundwater.

Contaminated portions of concrete structures will also be removed to eliminate possible dermal exposure and potential future inhalation of contaminated concrete particles if the structures are ever demolished.

No unacceptable short-term risks or cross-media impacts will be caused by implementation of the remedy. Soil excavation and concrete removal could involve short-term exposure through inhalation of contaminated soil particles by site workers and nearby residents, and dermal contact with contaminated soils by site workers. These exposures can be eliminated through the use of air monitoring and proper dust control measures during remedial activities, and by implementing a strict site-specific health and safety plan. Inhalation exposure during the incineration phase will be reduced to acceptable levels with proper air emissions control equipment, which will be part of the incinerator unit.

Compliance with ARARs

The selected remedy will comply with all applicable, relevant, and appropriate requirements. The following ARARs apply:

Chemical-Specific ARARs

Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) are relevant and appropriate to the cleanup of groundwater at the FMC site. None of the contaminants of concern have been detected at levels exceeding their MCLs. No cleanup levels have been set for contaminant levels in soil under state or federal regulations that apply to the site-specific contaminants.

Location-Specific ARARs

No location-specific ARARs affect the remedial action to be implemented at the FMC site.

Action-Specific ARARs

Action-specific ARARs are technology-or activity-based requirements or limitations on actions affecting hazardous wastes. These requirements are triggered by the particular remedial activities selected to cleanup the site. Soils and groundwater contaminated with listed wastes must be handled as hazardous wastes, under RCRA, when these materials are excavated, demolished, or extracted. Incineration of these and other contaminated materials will require performance standards for hazardous waste incinerators to be met. Federal and State air standards are administered at the local level and emissions from the incinerator will comply with these standards.

Other action-specific ARARs include RCRA requirements for clean closure, as well as storage and off-site disposal of contaminated materials. Since hazardous materials may be placed as a result of the actions specified in this document, the Land Disposal Restrictions will apply; these requirements will be met by either meeting appropriate LDR standards, obtaining a treatability variance, or in the case of the ash, delisting, as the ash should no longer be hazardous.

Cost-Effectiveness

The selected remedy is cost effective when the degree of protectiveness it provides is compared to the overall protectiveness provided by the non-destructive technologies. When

compared to the cost of the other alternatives involving incineration, the selected remedy is significantly more cost effective than off-site incineration. Alternative 3, soil washing and off-site incineration, does not offer any significant savings over the selected remedy, and is more expensive as the volume of soils to be remediated increases above the minimum estimate.

Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable (MEP)

Four of the alternatives, including the one selected, provide permanent treatment based remedies. In selecting a remedy emphasis was placed on the reduction of toxicity, mobility, and volume and long-term effectiveness and permanence. Alternatives 1, 2, and 7 clearly do not meet all of these goals.

The alternatives involving incineration all meet these criteria, and use the best available technology (BAT) for the site contaminants. Alternative 3, soil washing and off-site incineration, would employ an alternative treatment technology, but would not offer any cost savings to offset the greater degree of uncertainty associated with it. Alternative 5, off-site incineration, is significantly more expensive than any of the other options without offering any greater degree of effectiveness, and may involve greater short term risks. Alternative 4 was the least proven and did not offer savings that might justify its use.

Alternative 6, excavation and on-site incineration of contaminated soils and concrete debris, provides a permanent solution with a proven technology , minimal uncertainty, and minimal long-and short-term risks.

Preference for Treatment as a Principal Element

The statutory preference for treatment that permanently and significantly reduces the toxicity, mobility, or volume of hazardous substances as a principal element is met by the use of a thermal destruction technology. Contaminants will be destroyed to the maximum extent practicable. This technology will provide a permanent reduction in the mobility, toxicity, and volume of the site contamination.

XI. RESPONSIVENESS SUMMARY

Background of Community Involvement

EPA conducted community interviews in July 1987, and found community interest in the site to be low. The local officials expressed concern over the immediate protection of human health.

The concerns expressed to EPA during community interviews were:

1) Citizens wanted timely and accurate information on the site.
2) Citizens expressed concern over possible groundwater contamination because of Yakima's high water table.

Comments Received

EPA held a public comment period from June 25, 1990 to July 25, 1990. On August 11, 1990, EPA held a public meeting for interested members of the community. Three community members, a representative of the local air board, and FMC staff attended the meeting. No comments or questions were received during the public meeting or the comment period.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

ADMINISTRATIVE RECORD INDEX
for
FMC CORPORATION SUPERFUND SITE
Yakima, Washington

September 19, 1990

FMC CORPORATION - ADMINISTRATIVE RECORD INDEX

HEADING: 1. 0. . SITE IDENTIFICATION

SUB-HEAD: 1. 1. . Correspondence

1. 1. . - 0001 DATE: 03/07/80 PAGES: 1
AUTHOR: Carolyn Wilson/Unknown
ADDRESSEE: John Barich/EPA
DESCRIPTION: Need for information regarding pesticides and spills

1. 1. . - 0002 DATE: 03/31/80 PAGES: 1
AUTHOR: Jim Hileman/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: Additional information regarding pesticides and spills

1. 1. . - 0003 DATE: 12/22/82 PAGES: 1
AUTHOR: Unknown/
ADDRESSEE: Files/
DESCRIPTION: Background information

1. 1. . - 0004 DATE: 05/24/83 PAGES: 5
AUTHOR: Chet Morton, Mike Kemp/CH2M Hill
ADDRESSEE: Joan McNamee/EPA
DESCRIPTION: Memorandum regarding remedial investigation to determine the amount of agricultural chemicals remaining in the site area

1. 1. . - 0005 DATE: 08/01/83 PAGES: 1
AUTHOR: Unknown/
ADDRESSEE: Unknown/
DESCRIPTION: Memorandum regarding interconnection between aquifers

1. 1. . - 0006 DATE: 09/27/83 PAGES: 1
AUTHOR: Unknown/
ADDRESSEE: Unknown/
DESCRIPTION: Soil sampling memorandum

FMC CORPORATION - ADMINISTRATIVE RECORD INDEX

1. 1. . - 0007 DATE: 10/27/87 PAGES: 2
AUTHOR: Norma Lewis/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: Site visit memorandum

SUB-HEAD: 1. 2. . Notification/Site Inspection Reports

1. 2. . - 0001 DATE: 02/15/80 PAGES: 10
AUTHOR: Jim Hileman/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: Site inspection report

1. 2. . - 0002 DATE: 03/07/80 PAGES: 2
AUTHOR: James Hileman/EPA
ADDRESSEE: John Barich/EPA
DESCRIPTION: Memorandum regarding potential hazardous site inspection

1. 2. . - 0003 DATE: 03/07/80 PAGES: 2
AUTHOR: J.C. Willman/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: Evaluation of Section 311 cleanup requirements

1. 2. . - 0004 DATE: 06/19/81 PAGES: 5
AUTHOR: Ernest Snowder/FMC
ADDRESSEE: Files/EPA
DESCRIPTION: Notification of hazardous waste

1. 2. . - 0005 DATE: 06/29/82 PAGES: 10
AUTHOR: Peter Evers,Jacqueline Betz/Ecology and Environment (E & E)
ADDRESSEE: John Osborn/E & E
DESCRIPTION: Site Inspection Report

1. 2. . - 0006 DATE: 07/08/82 PAGES: 39
AUTHOR: Jacqueline Betz/E & E
ADDRESSEE: John Osborn/EPA
DESCRIPTION: Memorandum regarding preliminary field investigation

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SUB-HEAD: 1. 3. . Preliminary Assessment Reports

1. 3. . - 0001 DATE: 02/01/80 PAGES: 7
AUTHOR: J.W. Fey/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: Potential hazardous waste site identification and preliminary assessment

1. 3. . - 0002 DATE: 04/16/80 PAGES: 2
AUTHOR: Roger Fuentes/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: Tentative disposition

1. 3. . - 0003 DATE: 04/21/82 PAGES: 2
AUTHOR: Roger Fuentes/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: Final strategy determination

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HEADING: 2. 0. . STATE LEAD INVESTIGATION

SUB-HEAD: 2. 1. . Correspondence

2. 1. . - 0001 DATE: 10/22/81 PAGES: 1
AUTHOR: Judi Schwarz/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: Status of current situation at Farm Machinery Corporation (FMC)

SUB-HEAD: 2. 2. . Sampling and Analysis Plans

2. 2. . - 0001 DATE: 04/11/83 PAGES: 2
AUTHOR: D.A. Lewis, D.B. Watson/FMC
ADDRESSEE: Unknown/
DESCRIPTION: Pit soil sampling

2. 2. . - 0002 DATE: 05/27/83 PAGES: 8
AUTHOR: /EPA
ADDRESSEE: Unknown/
DESCRIPTION: Provisions for approval of pit soil sampling with attached determination of pesticides and PCBs in sediments

SUB-HEAD: 2. 3. . Sampling and Analysis Data

2. 3. . - 0001 DATE: 05/27/83 PAGES: 5
AUTHOR: /McKesson Environmental Services
ADDRESSEE: /Washington Department of Ecology (WDOE)
DESCRIPTION: Soil sampling and analytical results

SUB-HEAD: 2. 4. . RCRA/State Dangerous Waste Closure Plan/Removal

2. 4. . - 0001 DATE: 06/27/86 PAGES: 12
AUTHOR: David Lewis/FMC
ADDRESSEE: Dennis Bowhay/WDOE
DESCRIPTION: Analytical results of samples taken from the pit on 4/21/86 and Work Safety Plan for removing material from pit

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HEADING: 3. 0. . REMEDIAL INVEST./PHASE I-POTENTIALLY RESPONSIBLE PARTY (PRP) LEAD

SUB-HEAD: 3. 1. . Correspondence

3. 1. . - 0001 DATE: 02/25/87 PAGES: 1
AUTHOR: Dennis Bowhay/WDOE
ADDRESSEE: Files/WDOE
DESCRIPTION: Notes discussing groundwater monitoring and RCRA closure

3. 1. . - 0002 DATE: 03/09/87 PAGES: 4
AUTHOR: Kathy Davidson/EPA
ADDRESSEE: Tim Brincefield, et al./EPA
DESCRIPTION: Memorandum concerning WDOE request for management assistance with attached project narrative statement

3. 1. . - 0003 DATE: 04/22/87 PAGES: 1
AUTHOR: Unknown/
ADDRESSEE: Unknown/
DESCRIPTION: Notification of commencement of remedial investigation work

3. 1. . - 0004 DATE: 04/28/87 PAGES: 4
AUTHOR: Judi Schwarz/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: Memorandum concerning possible elements for remedial investigation

3. 1. . - 0005 DATE: 05/26/87 PAGES: 10
AUTHOR: Judi Schwarz/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: Trip to Yakima WDOE office and FMC

3. 1. . - 0006 DATE: 06/04/87 PAGES: 2
AUTHOR: Michael Kuntz/WDOE
ADDRESSEE: Files/WDOE
DESCRIPTION: Review of preliminary remedial investigation feasibility study work plan dated 5/87

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3. 1. . - 0007 DATE: 06/15/87 PAGES: 7
AUTHOR: Judi Schwarz/EPA
ADDRESSEE: David Lewis/FMC
DESCRIPTION: Preliminary comments on FMC 5/28/87 proposal

3. 1. . - 0008 DATE: 09/25/87 PAGES: 6
AUTHOR: Loren McPhillips/EPA
ADDRESSEE: David Lewis/FMC
DESCRIPTION: Comments on quality assurance project plan

3. 1. . - 0009 DATE: 10/05/87 PAGES: 3
AUTHOR: David Lewis/FMC
ADDRESSEE: John Yellich/Union Pacific Corporation
DESCRIPTION: Response to comments on proposed work plan

3. 1. . - 0010 DATE: 10/29/87 PAGES: 1
AUTHOR: Loren McPhillips/EPA
ADDRESSEE: David Lewis/FMC
DESCRIPTION: Letter submitting conditional approval of start of field work

3. 1. . - 0011 DATE: 11/09/87 PAGES: 1
AUTHOR: John Yellich/Union Pacific
ADDRESSEE: Dave Lewis/FMC
DESCRIPTION: Review of revised work plan

3. 1. . - 0012 DATE: 05/12/88 PAGES: 9
AUTHOR: Loren McPhillips/EPA
ADDRESSEE: Dave Lewis/FMC
DESCRIPTION: Comments on Phase I Remedial Investigation Report

3. 1. . - 0013 DATE: 07/08/88 PAGES: 4
AUTHOR: David Lewis/FMC
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Respose to comments on Phase I Remedial Investigation Report

FMC CORPORATION - ADMINISTRATIVE RECORD INDEX

3. 1. . - 0014 DATE: / / PAGES: 7
AUTHOR: Wayne Grotheer/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: Summary of agricultural pesticides and groundwater sampling with attached notes regarding groundwater sampling

SUB-HEAD: 3. 2. . Technical Negotiations

3. 2. . - 0001 DATE: 04/24/87 PAGES: 1
AUTHOR: Unknown/
ADDRESSEE: Unknown/
DESCRIPTION: Memorandum concerning desire of Upland to be involved in negotiations

3. 2. . - 0002 DATE: 06/09/87 PAGES: 1
AUTHOR: Robert McManus/FMC
ADDRESSEE: Unknown/
DESCRIPTION: Memorandum concerning remedial investigation limits

3. 2. . - 0003 DATE: 06/19/87 PAGES: 3
AUTHOR: Unknown/
ADDRESSEE: Unknown/
DESCRIPTION: Memorandum regarding quality assurance guidance and sampling plan

3. 2. . - 0004 DATE: 06/26/87 PAGES: 2
AUTHOR: Unknown/
ADDRESSEE: Unknown/
DESCRIPTION: Memorandum regarding scope of remedial investigation

SUB-HEAD: 3. 3. . Work Plans

3. 3. . - 0001 DATE: 05/28/87 PAGES: 26
AUTHOR: David Lewis/FMC
ADDRESSEE: Charles Findley/EPA
DESCRIPTION: FMC good faith proposal with attached preliminary work plan

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3. 3. . - 0002 DATE: 07/01/87 PAGES: 26
AUTHOR: /Bechtel Environmental
ADDRESSEE: /FMC Corporation
DESCRIPTION: Scope of Work

3. 3. . - 0003 DATE: 07/06/87 PAGES: 28
AUTHOR: David Lewis/FMC
ADDRESSEE: Judi Schwarz/EPA
DESCRIPTION: Cover letter with revised scope of work (Bechtel)

3. 3. . - 0004 DATE: 08/01/87 PAGES: 62
AUTHOR: /Bechtel Environmental
ADDRESSEE: /FMC Corporation
DESCRIPTION: Quality Assurance Project Plan

3. 3. . - 0005 DATE: 07/14/87 PAGES: 67
AUTHOR: D. Lewis/FMC
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Transmittal Letter with Quality Assurance Project Plan (Bechtel)

3. 3. . - 0006 DATE: 10/19/88 PAGES: 6
AUTHOR: Loren McPhillips/EPA
ADDRESSEE: /
DESCRIPTION: Quality Assurance Project Plan for Sampling and Analysis at FMC Yakima 10/88

3. 3. . - 0007 DATE: / / PAGES: 8
AUTHOR: EPA/Region X Laboratory
ADDRESSEE: /
DESCRIPTION: Provisions for Approval of the Plan (Determination of Pesticides and PCB's in Sediments - Gas Chromotographic Method)

SUB-HEAD: 3. 4. . Sampling and Analysis Plans/Protocol

FMC CORPORATION - ADMINISTRATIVE RECORD INDEX

3. 4. . - 0001 DATE: 11/04/87 PAGES: 21
AUTHOR: Kim Eichhoff/Bechtel Environmental
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Quality assurance and control at International Technology (IT) Corporation with attached quality assurance summary

3. 4. . - 0002 DATE: 11/24/87 PAGES: 6
AUTHOR: Kim Eichhoff/Bechtel Environmental
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: IT Corporation laboratory work with attached list of laboratory deliverables

SUB-HEAD: 3. 5. . Sampling and Analysis Data

3. 5. . - 0001 DATE: / / PAGES: 1
AUTHOR: Loren McPhillips/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: DDT levels in soil samples

SUB-HEAD: 3. 6. . Oversight of Remedial Investigation/Phase I

3. 6. . - 0001 DATE: 08/13/87 PAGES: 8
AUTHOR: Roger Williams/Jacobs Engineering
ADDRESSEE: Jack Jojokian/EPA
DESCRIPTION: Work Plan

3. 6. . - 0002 DATE: 12/10/87 PAGES: 57
AUTHOR: Rosemary Glen/Jacobs Engineering
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Letter report summarizing field activities during 11/10-17/87

3. 6. . - 0003 DATE: 12/22/87 PAGES: 6
AUTHOR: Dale Hammermeister/Jacobs Engineering
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Letter containing estimates of persistance of pesticides

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3. 6. . - 0004 DATE: 02/18/88 PAGES: 4
AUTHOR: Dale Hammermeister/Jacobs Engineering
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Preliminary review of insecticide analytical data from soil and groundwater samples

3. 6. . - 0005 DATE: 03/10/88 PAGES: 1
AUTHOR: Dale Hammermeister/Jacobs Engineering
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Letter regarding emergency removal of disposal pit

3. 6. . - 0006 DATE: 03/30/88 PAGES: 12
AUTHOR: Larry Phyffe/Jacobs Engineering
ADDRESSEE: Unknown/EPA
DESCRIPTION: Field notes regarding groundwater sampling by Bechtel 3/28-30/88

3. 6. . - 0007 DATE: 03/29/88 PAGES: 7
AUTHOR: Lynn Paxon, Larry Phyffe/Jacobs Engineering
ADDRESSEE: Unknown/EPA
DESCRIPTION: Photographs regarding groundwater sampling

3. 6. . - 0008 DATE: 04/03/88 PAGES: 3
AUTHOR: Dale Hammermeister/Jacobs Engineering
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Summary of oversight of groundwater activities from 3/28 - 30/88

3. 6. . - 0009 DATE: 04/13/88 PAGES: 3
AUTHOR: Dale Hammermeister/Jacobs Engineering
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Review of Phase I Report

3. 6. . - 0010 DATE: 04/21/88 PAGES: 8
AUTHOR: Dale Hammermeister/Jacobs Engineering
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Letter suggesting changes in field measurement methodology, measurement scheduling, and sample preparation with attached memorandum regarding toxicological review of FMC

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3. 6. . - 0011 DATE: 05/13/88 PAGES: 8
AUTHOR: Dale Hammermeister/Jacobs Engineering
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Review of split sample data from facility cleanup

SUB-HEAD: 3. 7. . Reports - Remedial Investigation/Phase I

3. 7. . - 0001 DATE: 03/17/88 PAGES: 81
AUTHOR: D. Lewis/FMC
ADDRESSEE: L. McPhillips/EPA
DESCRIPTION: Transmittal letter with Phase I Remedial Investigation Report for a Former Pesticide Formulation Plan, Yakima, Washington (Bechtel)

3. 7. . - 0002 DATE: 07/01/88 PAGES: 82
AUTHOR: /Bechtel Environmental
ADDRESSEE: /FMC Corporation
DESCRIPTION: Revised Phase I Remedial Investigation Report for a Former Pesticide Formulation Plant, Yakima, Washington

SUB-HEAD: 3. 8. 1. Correspondence

3. 8. 1. - 0001 DATE: 05/12/88 PAGES: 9
AUTHOR: John Yellich, Edward Hynes/Union Pacific
ADDRESSEE: David Lewis/FMC Corporation
DESCRIPTION: Comments on site investigation report

SUB-HEAD: 3. 8. 2. Work Plans

3. 8. 2. - 0001 DATE: 06/25/87 PAGES: 19
AUTHOR: D. Lewis/FMC
ADDRESSEE: J. Yellich/Union Pacific
DESCRIPTION: Transmittal letter with Work Plan for Proposed Investigation and Cleanup (Bechtel)

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3. 8. 2. - 0002 DATE: 09/01/87 PAGES: 19
AUTHOR: /Bechtel Environmental
ADDRESSEE: /FMC Corporation
DESCRIPTION: Revised work plan for investigation and cleanup

SUB-HEAD: 3. 8. 3. Sampling and Analysis Data

3. 8. 3. - 0001 DATE: 04/22/88 PAGES: 8
AUTHOR: Edward L. Hynes/Union Pacific Corp.
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Cover letter and attached analytical results from facilities area sampling conducted in November 1987

SUB-HEAD: 3. 8. 4. Site Investigation Report

3. 8. 4. - 0001 DATE: 04/01/88 PAGES: 41
AUTHOR: /Bechtel Environmental
ADDRESSEE: /FMC Corporation
DESCRIPTION: Site Investigation Report with attached transmittal letter

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HEADING: 4. 0. . REMEDIAL INVESTIGATION/PHASE II - PRP LEAD

SUB-HEAD: 4. 1. . Correspondence/Comments

4. 1. . - 0001 DATE: 02/08/89 PAGES: 1
AUTHOR: David A. Lewis/FMC
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Letter accompanying revised RI/FS work plan and providing comments on revised work plan

4. 1. . - 0002 DATE: 03/27/89 PAGES: 2
AUTHOR: David A. Lewis/FMC
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Enclosure letter offering comments on Phase II Remedial Investigation activities

4. 1. . - 0003 DATE: 10/30/89 PAGES: 1
AUTHOR: David A. Lewis/FMC
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Enclosure letter for draft reports

4. 1. . - 0004 DATE: 05/02/90 PAGES: 1
AUTHOR: David A. Lewis/FMC
ADDRESSEE: Nick Ceto/EPA
DESCRIPTION: Enclosure letter for revised Phase II Remedial Investigation Report, Vol. 1

4. 1. . - 0005 DATE: 05/03/90 PAGES: 1
AUTHOR: David A. Lewis/FMC
ADDRESSEE: Nick Ceto/EPA
DESCRIPTION: Enclosure letter for proposed Scope of Work for the Installation of Three New Monitoring Wells

4. 1. . - 0006 DATE: 05/29/90 PAGES: 1
AUTHOR: David A. Lewis/FMC
ADDRESSEE: Nick Ceto/EPA
DESCRIPTION: Enclosure letter for FMC's responses to comments on the FMC-Yakima draft RI Report, Risk Assessment, and Feasibility Study Report

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4. 1. . - 0007 DATE: 06/12/90 PAGES: 1
AUTHOR: Nick Ceto/EPA
ADDRESSEE: David A. Lewis/FMC
DESCRIPTION: Letter commenting on revised RI/FS and Risk Assessment reports, and Proposed Scope of Work for Three Monitoring Wells, and noting that wells must be installed and sampled by end of June

SUB-HEAD: 4. 2. . Risk Assessment Methodology

4. 2. . - 0001 DATE: 09/01/89 PAGES: 10
AUTHOR: Bechtel Environmental/
ADDRESSEE: Prepared for FMC Corporation/
DESCRIPTION: Risk Assessment Methodology Report for the FMC Yakima Site

SUB-HEAD: 4. 3. . Remedial Investigation Report

4. 3. . - 0001 DATE: 04/01/90 PAGES: 156
AUTHOR: Bechtel Enviromental, Inc./
ADDRESSEE: FMC Corporation/
DESCRIPTION: Phase II Remedial Investigation Report for a Former Pesticide Formulation Facility in Yakima, Washington Volume 1

4. 3. . - 0002 DATE: 04/01/90 PAGES: 361
AUTHOR: Bechtel Enviromental, Inc./
ADDRESSEE: FMC Corporation/
DESCRIPTION: Phase II Remedial Investigation Report for a Former Pesticide Formulation Facility in Yakima, Washington Volume 2

SUB-HEAD: 4. 4. . Scope of Work - Monitoring Well Installation

4. 4. . - 0001 DATE: 05/01/90 PAGES: 4
AUTHOR: Bechtel Environmental, Inc./
ADDRESSEE: /
DESCRIPTION: Proposed Scope of Work for the Installation of Three Monitoring Wells at the FMC Yakima Site

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4. 4. . - 0002 DATE: 05/01/90 PAGES: 3
AUTHOR: Bechtel Environmental, Inc./
ADDRESSEE: /
DESCRIPTION: Proposed Scope of Work for the Installation of Three Monitoring Wells at the FMC Yakima Site

SUB-HEAD: 4. 5. . Other Reports

4. 5. . - 0001 DATE: 09/07/90 PAGES: 14
AUTHOR: PRC Environmental/
ADDRESSEE: EPA/
DESCRIPTION: Health-Based Goals for Remediation of the Contaminated Concrete at the FMC Yakima Site

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HEADING: 5. 0. . REMOVAL RESPONSE - PRP LEAD

SUB-HEAD: 5. 1. . Correspondence

5. 1. . - 0001 DATE: / / PAGES: 1
AUTHOR: Unknown/
ADDRESSEE: Unknown/
DESCRIPTION: Memorandum concerning cleanup levels

5. 1. . - 0002 DATE: / / PAGES: 1
AUTHOR: Unknown/
ADDRESSEE: Unknown/
DESCRIPTION: Memorandum concerning field work

SUB-HEAD: 5. 2. . Removal Action Plan

5. 2. . - 0001 DATE: 06/03/88 PAGES: 1
AUTHOR: Judi Schwarz/EPA
ADDRESSEE: David Lewis/FMC Corporation
DESCRIPTION: EPA approval of revised removal action plan with attached plan

5. 2. . - 0002 DATE: 05/01/88 PAGES: 90
AUTHOR: /Bechtel Environmental
ADDRESSEE: /FMC Corporation
DESCRIPTION: Removal Action Plan for Pit Excavation at the Former FMC Pesticide Formulation Facility in Yakima, Washington Revision 1.0

SUB-HEAD: 5. 3. . Pit Excavation Report

5. 3. . - 0001 DATE: 07/01/88 PAGES: 85
AUTHOR: /Bechtel Environmental
ADDRESSEE: /FMC Corporation
DESCRIPTION: Pit Excavation at the Former FMC Pesticide Formulation Facility in Yakima, Washington

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5. 3. . - 0002 DATE: 12/01/88 PAGES: 163
AUTHOR: Bechtel Environmental/
ADDRESSEE: Prepared for FMC Agricultural Chemical Group/
DESCRIPTION: Disposal Pit Excavation Report for a Former FMC Pesticide Formulation Facility in Yakima, Washington

5. 3. . - 0003 DATE: 09/01/89 PAGES: 41
AUTHOR: Bechtel Environmental/
ADDRESSEE: Prepared for FMC Agricultural Chemical Group/
DESCRIPTION: Phase II Pit Excavation Report for a Former FMC Pesticide Formulation Facility in Yakima, Washington

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HEADING: 6. 0. . FEASIBILITY STUDY

SUB-HEAD: 6. 1. . Correspondence/Comments

6. 1. . - 0001 DATE: 03/15/90 PAGES: 35
AUTHOR: Nicholas Ceto III/EPA
ADDRESSEE: David A. Lewis/FMC Corporation
DESCRIPTION: Letter providing comments on draft Feasibility Study report Phase II Remedial Investigation Report

6. 1. . - 0002 DATE: 05/29/90 PAGES: 73
AUTHOR: David A. Lewis/FMC
ADDRESSEE: Nicholas Ceto/EPA
DESCRIPTION: FMC's responses to the comments on the FMC Yakima draft Remedial Investigation Report, Risk Assessment and Feasibility Study Report

6. 1. . - 0003 DATE: 06/12/90 PAGES: 3
AUTHOR: David A. Lewis/FMC
ADDRESSEE: Nicholas Ceto/EPA
DESCRIPTION: Letter indicating FMC's preferred remedial alternative for the FMC Yakima site

SUB-HEAD: 6. 2. . Feasibility Study Report

6. 2. . - 0001 DATE: 04/01/90 PAGES: 220
AUTHOR: Bechtel Enviromental, Inc./
ADDRESSEE: FMC Corporation/
DESCRIPTION: Phase II Feasibility Study Report for a Former Pesticide Formulation Facility in Yakima, Washington

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HEADING: 7. 0. . RECORD OF DECISION

SUB-HEAD: 7. 1. . Record of Decision

7. 1. . - 0001 DATE: 09/01/90 PAGES: 50
AUTHOR: EPA/
ADDRESSEE: /
DESCRIPTION: Record of Decision : Declaration, Decision Summary, and Responsiveness Summary for Remedial Action at FMC Corporation, Yakima, Washington

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HEADING: 8. 0. . STATE COORDINATION

SUB-HEAD: 8. 1. . Correspondence

8. 1. . - 0001 DATE: 06/18/85 PAGES: 2
AUTHOR: Kathryn Davidson/EPA
ADDRESSEE: Ken Back/Washington Planning and Community Affairs Agency
DESCRIPTION: Notification of proposed Superfund Project

8. 1. . - 0002 DATE: 03/17/87 PAGES: 6
AUTHOR: Dennis Bowhay/WDOE
ADDRESSEE: Clar Pratt/WDOE
DESCRIPTION: Recommendation on involvement with FMC-Yakima site

8. 1. . - 0003 DATE: 07/02/87 PAGES: 2
AUTHOR: Barbara Turner/Bechtel Environmental
ADDRESSEE: William Miller/WDOE
DESCRIPTION: Request for variance from minimum standards for construction of maintenance of water wells

8. 1. . - 0004 DATE: 07/15/87 PAGES: 1
AUTHOR: William Miller/WDOE
ADDRESSEE: Barbara Turner/Bechtel Environmental
DESCRIPTION: Response to request for variance from minimum standards for construction of maintenance of water wells

8. 1. . - 0005 DATE: 03/04/88 PAGES: 26
AUTHOR: David Roundtry/WDOE
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Comments regarding FMC pit removal with attached letter and memorandum regarding EPA revised procedures for planning and implementing offsite response actions

8. 1. . - 0006 DATE: 04/12/88 PAGES: 3
AUTHOR: Michael Kuntz/WDOE
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Comments on Remedial Investigation/Phase I Report

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8. 1. . - 0007 DATE: 04/20/88 PAGES: 2
AUTHOR: Michael Kuntz/WDOE
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Comments on draft removal consent order

8. 1. . - 0008 DATE: 06/12/90 PAGES: 2
AUTHOR: Michael Kuntz/DOE
ADDRESSEE: Nick Ceto/EPA
DESCRIPTION: FMC-Yakima/Ecology review of draft proposed work plan for preferred alternative faxed on June 1, 1990

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HEADING: 9. 0. . ENFORCEMENT

SUB-HEAD: 9. 1. . Correspondence

9. 1. . - 0001 DATE: 08/06/87 PAGES: 1
AUTHOR: David Lewis/FMC Corporation
ADDRESSEE: Judi Schwarz/EPA
DESCRIPTION: Designation of project coordinator

9. 1. . - 0002 DATE: 06/03/88 PAGES: 1
AUTHOR: David Lewis/FMC Corporation
ADDRESSEE: Judi Schwarz/EPA
DESCRIPTION: Designation of project coordinator

SUB-HEAD: 9. 2. . Notification Letters and Requests for Information

9. 2. . - 0001 DATE: 01/02/87 PAGES: 5
AUTHOR: Charles Findley/EPA
ADDRESSEE: David Lewis/FMC Corporation
DESCRIPTION: Notification of documented release or threatened release of hazardous substances and listing of FMC Corporation on the National Priorities List and potential liability

9. 2. . - 0002 DATE: 01/02/87 PAGES: 5
AUTHOR: Charles Findley/EPA
ADDRESSEE: Christine Smith/Upland Industries
DESCRIPTION: Notification of documented release or threatened release of hazardous substances and listing of FMC Corporation on the National Priorities List and potential liability

9. 2. . - 0003 DATE: 03/17/87 PAGES: 2
AUTHOR: Christine Smith/Upland Industries
ADDRESSEE: Charles Findley/EPA
DESCRIPTION: Response to notification of potential liability

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9. 2. . - 0004 DATE: 03/24/87 PAGES: 2
AUTHOR: Charles Findley/EPA
ADDRESSEE: Christine Smith/Upland Industries
DESCRIPTION: Notification regarding EPA determination that a remedial investigation and feasibility study be undertaken and request for submission of good faith proposal

9. 2. . - 0005 DATE: 03/24/87 PAGES: 3
AUTHOR: Charles Findley/EPA
ADDRESSEE: David Lewis/FMC Corporation
DESCRIPTION: Notification regarding EPA determination that a remedial investigation and feasibility study be undertaken and request for submission of good faith proposal

9. 2. . - 0006 DATE: 04/10/87 PAGES: 2
AUTHOR: Christine Smith/Upland Industries
ADDRESSEE: Judi Schwarz/EPA
DESCRIPTION: Copy of print attached to 3/17/87 letter from Christine Smith to Charles Findley

9. 2. . - 0007 DATE: 03/08/88 PAGES: 2
AUTHOR: Charles Findley/EPA
ADDRESSEE: Christine Smith/Upland Industries
DESCRIPTION: Notification of determination to conduct a removal action on disposal pit

9. 2. . - 0008 DATE: 03/08/88 PAGES: 2
AUTHOR: Charles Findley/EPA
ADDRESSEE: David Lewis/FMC Corporation
DESCRIPTION: Notification of determination to conduct a removal action on disposal pit

9. 2. . - 0009 DATE: 03/21/88 PAGES: 3
AUTHOR: Christine Smith/Upland Industries
ADDRESSEE: Charles Findley/EPA
DESCRIPTION: Response to notification of determination to conduct a removal action on disposal pit

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9. 2. . - 0010 DATE: 03/22/88 PAGES: 1
AUTHOR: David Lewis/FMC Corporation
ADDRESSEE: L. McPhillips/EPA
DESCRIPTION: Response to notification of determination to conduct a removal action on disposal pit

SUB-HEAD: 9. 3. . Responses to Requests for Information

9. 3. . - 0001 DATE: 12/10/86 PAGES: 53
AUTHOR: Michale Dodson, et al./Pacific Testing Laboratories
ADDRESSEE: /Upland Corporation
DESCRIPTION: Report on preliminary structural condition evaluation

9. 3. . - 0002 DATE: 04/10/87 PAGES: 266
AUTHOR: Robert McManus/FMC Corporation
ADDRESSEE: Charles Findley/EPA
DESCRIPTION: Responses to requests for information outlined in 1/2/87 letter from EPA to FMC Corporation

SUB-HEAD: 9. 4. . Consent for Access Agreements

9. 4. . - 0001 DATE: 08/24/87 PAGES: 2
AUTHOR: Robert McManus/FMC Corporation
ADDRESSEE: Christine Smith/Upland Industries
DESCRIPTION: Termination of FMC leasehold interest at site

9. 4. . - 0002 DATE: 09/03/87 PAGES: 1
AUTHOR: Christine Smith/Upland Industries
ADDRESSEE: Robert McManus/FMC Corporation
DESCRIPTION: Response to 8/24/87 letter regarding termination of FMC leasehold interest

9. 4. . - 0003 DATE: 10/07/87 PAGES: 1
AUTHOR: David Lewis/FMC Corporation
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Letter regarding status of efforts to secure access to site

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9. 4. . - 0004 DATE: 10/14/87 PAGES: 1
AUTHOR: Unknown/
ADDRESSEE: Unknown/
DESCRIPTION: Memorandum concerning leasehold interest

9. 4. . - 0005 DATE: 11/03/87 PAGES: 4
AUTHOR: Vice President/Union Pacific
ADDRESSEE: /EPA, WDOE, and FMC Corporation
DESCRIPTION: Consent for Access to Property Agreement with attached Exhibits A and B

9. 4. . - 0006 DATE: 11/18/87 PAGES: 10
AUTHOR: Vice President/Union Pacific Land Resources Corporation
ADDRESSEE: /EPA, WDOE, and FMC Corporation
DESCRIPTION: Consent for Access to Property Agreement with attached Exhibits A and B and executed original with extra copy addressed to Allan Bakalian/EPA

9. 4. . - 0007 DATE: 05/24/88 PAGES: 2
AUTHOR: Christine Smith/Upland Industries
ADDRESSEE: Robert McManus/FMC Corporation
DESCRIPTION: FMC Corporation execution of Consent for Access to Property Agreement regarding removal action

9. 4. . - 0008 DATE: 05/24/88 PAGES: 4
AUTHOR: President/Union Pacific Land Resources Corporation
ADDRESSEE: /EPA, WDOE, and FMC Corporation
DESCRIPTION: Consent for Access to Property Agreement with attached Exhibits A and B

SUB-HEAD: 9. 5. 1. Washington Department of Ecology Order

9. 5. 1. - 0001 DATE: 06/10/83 PAGES: 11
AUTHOR: Bruce Cameron/WDOE
ADDRESSEE: /FMC Corporation
DESCRIPTION: WDOE Order No. DE 83-283 regarding implementation of sampling plan for disposal pit with attached plan, provisions for approval of plan, and report on the determination of pesticides and PCBs in sediments

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SUB-HEAD: 9. 5. 2. Remedial Investigation/Phase I Administrative Order

9. 5. 2. - 0001 DATE: 07/01/87 PAGES: 1
AUTHOR: Allan Bakalian/EPA
ADDRESSEE: Robert McManus/FMC Corporation
DESCRIPTION: Cover letter to proposed administrative order with agreed upon changes

9. 5. 2. - 0002 DATE: 07/31/87 PAGES: 29
AUTHOR: Robert Jaros; Charles Findley/FMC Corporation; EPA
ADDRESSEE: /FMC Corporation; EPA
DESCRIPTION: Adminstrative Order on Consent - No. 1086-11-05-104

SUB-HEAD: 9. 5. 3. Removal Response Administrative Order

9. 5. 3. - 0001 DATE: 05/11/88 PAGES: 1
AUTHOR: Allan Bakalian/EPA
ADDRESSEE: Robert McManus/FMC Corporation
DESCRIPTION: Letter concerning FMC approval and execution of order

9. 5. 3. - 0002 DATE: 05/24/88 PAGES: 1
AUTHOR: Robert McManus/FMC Corporation
ADDRESSEE: Allan Bakalian/EPA
DESCRIPTION: Cover letter to executed signed order

9. 5. 3. - 0003 DATE: 05/31/88 PAGES: 31
AUTHOR: Robert Jaros; Charles Findley/FMC Corporation; EPA
ADDRESSEE: /FMC Corporation; EPA
DESCRIPTION: Executed Administrative Order on Consent for Necessary Response Actions Pursuant to 42 U.S.C. Section 9606 - No. 1088-04-06-106

9. 5. 3. - 0004 DATE: 06/01/88 PAGES: 2
AUTHOR: Allan Bakalian/EPA
ADDRESSEE: Robert McManus/FMC Corporation
DESCRIPTION: Cover letter for Certified copy of original Consent Order No. 1088-04-06-106

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HEADING: 10. 0. . HEALTH ASSESSMENTS

SUB-HEAD: 10. 1. . Correspondence

10. 1. . - 0001 DATE: 03/01/88 PAGES: 1
AUTHOR: Unknown/
ADDRESSEE: Unknown/
DESCRIPTION: Memorandum regarding Agency for Toxic Substances Disease Registry

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HEADING: 11. 0. . NATURAL RESOURCE TRUSTEES

SUB-HEAD: 11. 1. . Correspondence

11. 1. . - 0001 DATE: 06/28/82 PAGES: 1
AUTHOR: Jacqueline Betz/Ecology and Environment
ADDRESSEE: Jim Botorff/U.S. Department of Interior
DESCRIPTION: Request for information regarding threatened or endangered species in Yakima area

11. 1. . - 0002 DATE: 07/01/82 PAGES: 1
AUTHOR: Joseph Blum/U.S. Department of Interior
ADDRESSEE: Jacqueline Betz/Ecology and Environment
DESCRIPTION: Response to request for information regarding threatened or endangered species

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HEADING: 13. 0. . PUBLIC PARTICIPATION

SUB-HEAD: 13. 1. . Public Correspondence

13. 1. . - 0001 DATE: 06/08/87 PAGES: 1
AUTHOR: Signe Gilson/CH2M Hill
ADDRESSEE: Files/CH2M Hill
DESCRIPTION: Memorandum concerning tentative appointments for community relations interviews

13. 1. . - 0002 DATE: 08/05/87 PAGES: 3
AUTHOR: Judi Schwarz/EPA
ADDRESSEE: Chief Beeson; Jime Whiteside; Don Steinmetz/Yakima City Fire Dept.; County Commissioner-County Courthouse; Yakima Health Dist.
DESCRIPTION: Input regarding community relations plan

13. 1. . - 0003 DATE: 08/05/87 PAGES: 1
AUTHOR: Judi Schwarz/EPA
ADDRESSEE: Cynthia Garrick/Yakima Region Library
DESCRIPTION: Request to use Yakima Library as information repository

13. 1. . - 0004 DATE: 08/28/87 PAGES: 4
AUTHOR: Loren McPhillips/EPA
ADDRESSEE: Chief Beeson; Jime Whiteside; Don Steinmetz/Yakima City Fire Dept.; County Commissioner-County Courthouse; Yakima Health Dist.
DESCRIPTION: Transmittal of draft quality assurance project plan (Letter also sent to Cynthia Garrick, Yakima Regional Library)

13. 1. . - 0005 DATE: 11/06/87 PAGES: 4
AUTHOR: Loren McPhillips/EPA
ADDRESSEE: Chief Beeson; Jime Whiteside; Don Steinmetz/Yakima City Fire Dept.; County Commissioner-County Courthouse; Yakima Health Dist.
DESCRIPTION: Transmittal of final quality assurance project plan (Letter also sent to Cynthia Garrick, Yakima Regional Library)

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13. 1. . - 0006 DATE: 06/06/88 PAGES: 1
AUTHOR: Judi Schwarz/EPA
ADDRESSEE: Cynthia Garrick/Yakima Region Library
DESCRIPTION: Transmittal of information to be added to site repository

SUB-HEAD: 13. 2. . Comments and Responses

13. 2. . - 0001 DATE: 05/02/88 PAGES: 12
AUTHOR: John Yellich, Edward Hynes/Union Pacific
ADDRESSEE: David Lewis/FMC Corporation
DESCRIPTION: Comments on Phase I Remedial Investigation Report with attached analytical report regarding split samples collected by Union Pacific Corporation

13. 2. . - 0002 DATE: 05/12/88 PAGES: 9
AUTHOR: John Yellich, Edward Hynes/Union Pacific
ADDRESSEE: David Lewis/FMC Corporation
DESCRIPTION: Comments on Site Investigation Report

13. 2. . - 0003 DATE: 07/31/90 PAGES: 1
AUTHOR: Elizabeth Tabbutt/Washington Environmental Council
ADDRESSEE: Nick Ceto/EPA
DESCRIPTION: Comments recommending cleanup Alternative #6

13. 2. . - 0004 DATE: 07/31/90 PAGES: 1
AUTHOR: Elizabeth Tabbutt/Washington Environmental Council
ADDRESSEE: Nick Ceto/EPA
DESCRIPTION: Letter commenting that Alternative 6 appears to provide the best means for cleanup of this site

SUB-HEAD: 13. 3. . Community Relations Plan

13. 3. . - 0001 DATE: 07/01/87 PAGES: 15
AUTHOR: /CH2M Hill
ADDRESSEE: /EPA
DESCRIPTION: Community Relations Plan

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SUB-HEAD: 13. 4. . Fact Sheets and Press Releases

13. 4. . - 0001 DATE: 08/05/87 PAGES: 2
AUTHOR: EPA/
ADDRESSEE: General Public/
DESCRIPTION: Fact sheet on the remedial investigation

13. 4. . - 0002 DATE: 11/06/87 PAGES: 1
AUTHOR: EPA/
ADDRESSEE: General Public/
DESCRIPTION: Fact sheet on the remedial investigation

13. 4. . - 0003 DATE: 06/03/88 PAGES: 3
AUTHOR: EPA/
ADDRESSEE: General Public/
DESCRIPTION: Fact sheet on removal action

13. 4. . - 0004 DATE: 02/09/90 PAGES: 1
AUTHOR: /EPA
ADDRESSEE: General Public/
DESCRIPTION: Fact sheet on FMC submittal of draft investigation and study reports

13. 4. . - 0005 DATE: 06/21/90 PAGES: 1
AUTHOR: EPA/
ADDRESSEE: General Public/
DESCRIPTION: Notice of news briefing on FMC Superfund site

SUB-HEAD: 13. 5. . Proposed Plan

13. 5. . - 0001 DATE: 06/20/90 PAGES: 7
AUTHOR: /EPA
ADDRESSEE: General Public/
DESCRIPTION: Fact Sheet FMC Superfund Site Yakima, Washington - The Proposed Plan

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SUB-HEAD: 13. 6. . Public Meeting Transcript

13. 6. . - 0001 DATE: 07/11/90 PAGES: 22
AUTHOR: /
ADDRESSEE: /
DESCRIPTION: FMC Superfund Site Yakima, Washington Public Meeting to Discuss Cleanup Alternatives and Receive Public Comments Verbatim Report of Proceedings The Proposed Plan

SUB-HEAD: 13. 7. . Public Notices

13. 7. . - 0001 DATE: 06/20/90 PAGES: 3
AUTHOR: EPA/
ADDRESSEE: /
DESCRIPTION: Notice of Public Comment period for proposed cleanup plan for FMC Yakima, Public Voucher for Advertising

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HEADING: 14. 0. . TECHNICAL SOURCES AND GUIDANCE DOCUMENTS

SUB-HEAD: 14. 1. . List of Guidance Documents Used

14. 1. . - 0001 DATE: 05/14/90 PAGES: 5
AUTHOR: EPA/
ADDRESSEE: File/
DESCRIPTION: List of EPA Guidances used

14. 1. . - 0002 DATE: 09/06/88 PAGES: 3
AUTHOR: David A. Lewis/FMC Corporation
ADDRESSEE: Loren McPhillips/EPA
DESCRIPTION: Title list used by FMC and Bechtel as guidance for Administrative Records in preparation of the Remedial Investigation Plan and Removal Plan

SUB-HEAD: 14. 2. . Technical Sources

14. 2. . - 0001 DATE: 03/01/86 PAGES: 21
AUTHOR: /EPA
ADDRESSEE: /EPA
DESCRIPTION: Water Quality Advisory - Endosulfan Sulfate

14. 2. . - 0002 DATE: 04/01/87 PAGES: 14
AUTHOR: /California State Water Resources Control Board, Morris Knudson Engineers
ADDRESSEE: /EPA
DESCRIPTION: Water quality and pesticides - endosulfan, with attached results of groundwater analysis at Crop King

14. 2. . - 0003 DATE: 01/01/85 PAGES: 2
AUTHOR: /1985 Farm Chemicals Handbook
ADDRESSEE: /EPA
DESCRIPTION: Data sheet on endosulfan

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14. 2. . - 0004 DATE: / / PAGES: 1
AUTHOR: Merck Index, 10th ed./
ADDRESSEE: /EPA
DESCRIPTION: Data sheet on endosulfan

14. 2. . - 0005 DATE: / / PAGES: 2
AUTHOR: /Handbook of Toxic and Hazardous Chemicals and Carcinogens
ADDRESSEE: /EPA
DESCRIPTION: Data sheet on endosulfan

14. 2. . - 0006 DATE: 01/01/86 PAGES: 10
AUTHOR: /1986 Farm Chemical Handbook
ADDRESSEE: /EPA
DESCRIPTION: Data sheets on DDA, DDE, DDT, parathion, captan, aramite, carbaryl, ethion, malathion, dinoseb, and dodine

14. 2. . - 0007 DATE: / / PAGES: 3
AUTHOR: Unknown/
ADDRESSEE: /EPA
DESCRIPTION: Data sheet on endosulfan

14. 2. . - 0008 DATE: 12/01/86 PAGES: 1
AUTHOR: Bechtel National Inc., San Francisco, CA/
ADDRESSEE: Prepared for FMC Corporation/
DESCRIPTION: Quality Assurance Project Plan: Remedial Investigation/Feasibility Study (RI/FS) for the FMC Fresno Plan Site (Report available at EPA Region 10 Headquarters, Superfund Branch, Seattle, WA)

14. 2. . - 0009 DATE: 12/01/86 PAGES: 1
AUTHOR: Bechtel National Inc., San Francisco, Ca/
ADDRESSEE: Prepared for FMC Corporation/
DESCRIPTION: Sampling Plan: RI/FS for the FMC Fresno Plant Site (Report available at EPA Region 10 Headquarters, Superfund Branch, Seattle, WA)

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14. 2. . - 0010 DATE: 12/01/86 PAGES: 0
AUTHOR: Bechtel National Inc., San Francisco, CA/
ADDRESSEE: Prepared for FMC Corporation/
DESCRIPTION: Work Plan: RI/FS for the FMC Fresno Plant Site (Report available at EPA Region 10 Headquarters, Superfund Branch, Seattle, WA)

SUB-HEAD: 14. 3. . Maps and Photos

14. 3. . - 0001 DATE: 05/26/87 PAGES: 8
AUTHOR: Judi Schwarz/EPA
ADDRESSEE: Files/EPA
DESCRIPTION: Inventory of slides taken by Judi Schwarz on 4/29-30/87 with attached maps and photo identification sheet

14. 3. . - 0002 DATE: 07/28/87 PAGES: 9
AUTHOR: Kim Eichhoff/Bechtel Environmental
ADDRESSEE: Judi Schwarz/EPA
DESCRIPTION: Transmittal with attached blowups of 1969 stereo pair photographs

14. 3. . - 0003 DATE: / / PAGES: 3
AUTHOR: Unknown/
ADDRESSEE: Unknown/
DESCRIPTION: Photographs of site

14. 3. . - 0004 DATE: / / PAGES: 1
AUTHOR: /Bechtel Environmental
ADDRESSEE: /FMC Corporation
DESCRIPTION: Map designating locations of trench sample contaminants found in highest concentrations

14. 3. . - 0005 DATE: 01/01/85 PAGES: 1
AUTHOR: /Bechtel Environmental
ADDRESSEE: /FMC Corporation
DESCRIPTION: Site location map

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14. 3. . - 0006 DATE: / / PAGES: 1
AUTHOR: Unknown/
ADDRESSEE: Unknown/
DESCRIPTION: Site location map

14. 3. . - 0007 DATE: 05/04/87 PAGES: 2
AUTHOR: /Upland Industries
ADDRESSEE: /EPA
DESCRIPTION: Survey of site (Document located at EPA Regional Headquarters - Region X, Seattle, WA Contact: Loren McPhillips or Judi Schwarz, Superfund Branch)